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Memorandum on the rate of growth of Teak.

By D. Brandis,

Inspector-General of Forests.

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For the Manual of Indian timbers, now under preparation, it was necessary to bring together all information available regarding the rate of growth of Teak, and it appears advisable to circulate the results at once with the view of eliciting further data in order to complete the account that will be given in the Manual. The following data were brought together with the assistance of Mr. A. Smythies, Assistant Conservator of Forests, Forest School Circle, North-Western Provinces.

2. A brief account of what was known regarding the rate of growth of Teak up to 1873 was given on pages 357-359

of the Forest Flora of North-West and Central India. Since then, further data have been collected; but the chief addition to our information on this subject has been made by the publication of Colonel Beddome's Report of 1878 on the Nilambur Teak Plantations. The data here brought together in no way give a complete account of the rate and mode of growth of Teak, and doubtless much more information is available which has not yet been published. It is a most important subject, which should now be taken up separately in each province where Teak is cultivated on a large scale, and its study is earnestly recommended. The following remarks will most conveniently be grouped under the head of annual rings, girth and height at different ages, cubic contents of individual trees, and the number of trees and cubic contents of growing stock per acre. It will be remembered that the rate of growth of every species varies between wide limits according to climate, soil and numerous other circumstances which affect the development of trees.

3. *Annual rings.*—It is now established beyond doubt that the concentric rings which are so marked in the wood of Teak correspond each to one year's growth. The following statement exhibits the rings counted on sections of trees grown in the Nilambur Plantations, which were cut in 1877. The sections were taken from the base of the stem, and, with a few exceptions, the number of rings agrees with the age of the tree. The average diameter is the mean of three diameters. The statement shows the gradual increase of the heart-wood as the tree grows older, and it also exhibits the number of rings on one inch of average radius in the wood of trees of different ages. But it must be borne in mind that these sections do not rep resent the average of each year's plantation, but were selected from among the dominant trees. They, therefore, exhibit a more rapid rate of growth than average specimens would do :—

Year of plantation.	Number of rings counted.	Average diameter of section (wood only.)	Average diameter of heart-wood.	Rings per inch of average radius.
		In inches.	In inches.	
1844 ...	33	20·8	19·3	3·17
1845 ...	31	21·1	18·7	2 95
1846 ...	31	20·	17·7	3·10
1847 ...	30	23·8	21·5	2 52
1848 ...	28	16·7	15·4	3 34
1849 ..	28	18·1	16 2	3·09
1850 ...	27	14·	12·5	3·85
1851 ...	25	15·2	13·4	3 28
1852 ...	32*	15·2	13·5	Omitted.
1853 ...	24	15·1	12·	3·17
1854 ...	24	17 3	15·2	2 77
1855 ...	23	12 4	10 5	3·71
1856 ...	21	15·2	12·6	2·76
1857 ...	20	12·2	10·6	3·27
1858 ...	19	14·	11·3	2 71
1859 ...	18	14·	10 6	2·57
1860 ...	17	12·9	10·4	2·63
1861 ...	16	13·1	10 5	2·44
1862 ...	15	11·7	9·	2·56
1863 ...	14	13·6	10 4	2 06
1864 ...	13	12 5	9·4	2·08
1865 ...	12	9·4	6·9	2 55
1866 ...	11	10 4	7 3	2·11
1867 ...	10	11·8	8·3	1·69
1868 ...	9	10·5	7·6	1·71
1869 ...	8	7·4	4·8	2 16
1870 ...	7	7·4	4·5	1·89
1871 ...	7	7 7	4·3	1·81
1872 ...	5	6·5	2·6	1·53
				Average 2·62 rings per inch of average radius.

4. The sections ranged in age from 5 to 33 years. Dividing them into three groups, two of 10 years each, and the third of nine years, we obtain the following as the mean diameter in inches of these three groups :—

		Inches.
Mean diameter of trees	5—14 years old ...	9·72
	15—24 „ ...	13·79
	25—33 „ ...	18·71

* There is evidently a mistake here. The tree which yielded this section must have been an older tree standing in the plantation of 1852.

A section sent from the Thinganneenoung Plantation in Burma, cut from a tree 21 years old, planted in 1856, gave 21 rings on a mean diameter of 16 3″, the heartwood of which occupied 14·5″. This section showed 2·57 rings per inch of average radius.

5. From other plantations also, sections of Teak trees of known age were sent for the Paris Exhibition, but apparently they were not in all cases cut from the base of the stem; they are, however, instructive as showing the rate of growth and the number of rings on one inch of mean radius.

Year of plantation.	Number of rings counted	Average diameter of section in inches		Rings per inch of average radius.
		Wood	Heartwood	
South Kanara (Parappa Plantation).				
Not known ...	10	9	4 9	2 22
" ..	5	5 5	2 5	1·81
North Kanara (Kalanadi Valley).				
Sulageri, 18 years old	18	8	6	4 5
	17	8 8	7 5	3 9
	17	9	7·	3 7
Murdi, 12 years old	8	7 5	Heartwood not distinct	2 1
	11	6		3 7
	11	5 7		3 8
Kadra, 10 years old	8	6 5	..	2 5
	8	7 5	5	2 1
	7	7	4	2
Bengal (Bamunpokri)				
1868	8	6 5	2 5	2 5
1871	6	6	1	2
1872	4	5·	1	1 6
Andamans (Port Blair).				
1873*	6	10 1	6.	1·2

6. It will be noticed that, as far as the data go, which are furnished by the sections received, Thinganneenoung and Bamunpokri exhibit an increase of diameter similar to that of Nilambur; while in the samples from North Kanara the annual rings are much narrower, and the specimen from Port Blair showed an extremely rapid rate of growth.

Girth and height at different ages.—The following measurements illustrate the rate of growth of Teak in plantations in

*The tree was probably older.

different provinces as nearly as possible from 5 to 5 years. The Nilambur Plantation again furnishes the largest amount of information :—

Age.	Mean girth at breast high.	Total height of tree.
Nilambur Plantation.—Alluvial soil.		
3—7 years ...	12 inches ...	29 feet.
8—12 „ ...	17 „ ...	63 „
13—17 „ ...	23 „ ...	68 „
18—22 „ ...	25 „ .	71 „
23—27 „ ...	27 „ ...	77 „
29 „ ...	34 „ ...	87 „
30 „ ...	35 „ ...	85 „
31 „ ...	32 „ ...	75 „
32 „ ...	34 „ ...	92 „
33 „ ...	37 „ ...	95 „
Nilambur Plantation.—Gneiss and laterite.		
7 years ...	13 inches ..	30 feet.
16 „ ...	14 „ ...	50 „
20 „ ...	21 „ ..	50 „
24—26 „ ...	22 „ ...	52 „
30 „ ...	24 „ ...	50 „

These figures are taken from that portion of Colonel Beddome's report (paragraphs 11— 44) which contains his notes on each year's plantation, and the data recorded are stated to be average figures.

8. In another part of his report (paragraph 81), however, he gives data which would seem to show that the average size of the trees in the older plantations (all on alluvial soil) is considerably greater. He there states the dimensions of the largest, smallest and medium-sized trees, four plantations, the results being as follows :—

Age.	Mean girth (probably breast high)			Length of bole.		
	Largest.	Medium.	Smallest.	Largest	Medium	Smallest.
	Inches.	Inches	Inches.	Feet.	Feet.	Feet.
30 years ...	67	47	29	79	65	50
31 „ ...	69	49	30	80	65	50
32 „ ...	63	46	30	83	67	50
33 „ ...	68	56	43	86	68	50

The first three lines show the average of 6 trees in each case, and the last line the average of 8 trees each. It is distinctly stated that the length is that of the bole, and not of the entire tree.

The plantations made on gneiss and laterite show a much slower rate of growth than those on alluvial soil ; the difference being considerable in height, and much less in girth.

9. Up to 10 years of age, the growth in length of teak on alluvial soil at Nilambur is at the rate of about 6 feet a year, and later on it is at the rate of only about 1 foot a year. On page 358 of the Forest Flora of North-West and Central India it is stated " that it is probable that, as a rule, Teak attains half its length with a girth of 2—3 feet." This assumption is borne out by the present figures. The trees grown upon alluvial soil in girth between 25 and 34 inches are from 77 to 87 feet high ; and from all that is known regarding the growth of Teak in similar localities, it is probable that unless damaged by storms, disease, insects, or other causes, they will attain a height of 150 feet in soil of this description, and in the climate of Nilambur.

10. From Burma we have the following data. The figures from Pegu represent averages of plantations in the Rangoon, Toungoo and Tharawaddee districts, brought together on page 358 of the Forest Flora of North-West and Central India :—

	Age, in years.	Mean girth, breast high, in inches.	Total height of tree, in feet.
Pegu	4	5—9	15—27
	10	15	40—45
	15	23	...
Thinganneenoung... ...	21	27	50—60
Garden—Moulmein	22	40	...

The fourth line is the average of 150 trees in the Thinganneenoung Plantation in the Attaran district of Tenasserim, given in paragraph 146 of the report for 1876-77 of the Tenasserim forests. Major Seaton gives the average height at 30—40 feet, but this probably means the height to the first

branch. The maximum girth was 55½ inches. The average rate of growth of the present plantations in Burma is somewhat less rapid than that of the alluvial portion of Nilambur. The last line gives the average of 15 trees measured in 1856 in a private garden at Moulmein. An instance of extremely rapid growth was the tree already mentioned, a section of which was sent from Port Blair for the Paris Exhibition, probably 6 years' old (said to have been planted in 1873, but 6 rings were counted), with a girth of 36 inches and a height of 44 feet.

11. For the Lakvalli Plantation in Mysore, the following data are given in Captain Van Someren's report for 1875-76. Age 13—15 years, mean girth 14 inches, height 32 feet. This is a remarkably slow rate of growth, considering that the soil is good, and the climate moist, though of course not so forcing as the climate of Nilambur.

12. The plantations in the Central Provinces and Berar have given the following:—

Plantation.	Age, in years.	Mean girth, breast high, in inches.	Total height of tree, in feet.
Machna, Central Provinces ...	6	7	15—22
Pili, Berar	6	4	10
Sakata, Central Provinces ...	7	11	20—25
Pili, Berar	8	8	20
Sonawani, Central Provinces ...	9	12	30—40
Machna, Central Provinces ...	8—10	9	17—30

Compared with Malabar and Burma, the rate of growth is slow, as may be expected in a dry climate and near the northern limit of the tree.

13. Outside the range of the natural growth of Teak, the following data, regarding its rate of growth, are available:—

Plantation.	Age, in years.	Mean girth, breast high, in inches.	Total height of tree, in feet.
Bamunpokri (Sikkim) ...	5	5·5	12—15
Kulsi (Assam)	5	11	29
Makum „ ...	4	9	18
„ „	5	11	27
„ „	7	16	31

The growth at that early age is fairly good; but it does not follow from these figures that Teak in Assam and Sikkim will attain a great age, and produce good timber.

14. The following instances of older trees of known age in Assam and Bengal are on record:—

Locality.	Number of trees measured.	Age, in years.	Mean girth, in inches.
Gauhati, banks of the Brahmaputra	15	37	85
Royal Botanical Gardens, Calcutta	19	6	16
Ditto ditto ...	8	70	79
Garden at Mohesh, Serampore...	27	50	52

The trees at Gauhati were on an average 30—50 feet high.

The trees in the Botanical Garden, Calcutta, were measured in January 1856. The older trees have since been blown down by the cyclones of 1864 and 1867.

On the banks of the Hooghly at Mohesh, below Serampore, stands a grove of Teak trees planted in 1828. Their mean girth, breast high, taken by measuring 27 average-sized trees, was 52 inches. The trees were measured in January 1878, and were therefore 50 years old. They are from 40—50 feet high.

15. In paragraphs 177 and 183 of Dr. Schlich's report for 1872-73, the dimensions of a large number of Teak trees at different stations of Lower Bengal are given; but unfortunately no trustworthy information regarding their age is available.

16. *Cubic contents of trees at different ages.*—In paragraph 4 of Colonel Beddome's report a statement is given exhibiting the dimensions of the trees, sections of which were sent to the Paris Exhibition. As already stated, these trees were selected as samples of the dominant trees, *viz.*, of those which will eventually be selected to remain on the ground as the ultimate crop; but, with few exceptions, they were not selected from among the largest individuals which had much outrun their neighbours. Arranging them in groups from 10 to 10 years, the following results are obtained:—

Age.	Height of tree, in feet	Girth at base, in inches.	Length of bole, in feet.	Mean cubic contents, in cubic feet.
4—13 years ...	48—75	21—60	32—56	10·6
14—23 „ ...	65—110	51—69	40—70	23·8
24—33 „ ...	70—110	60—105	41—72	51·3

This gives us the cubic contents at different ages as follows :—

Mean age.	Cubic contents, in cubic feet.	Periodical annual increment, in cubic feet.
9	10·6	1·1 to 9 years.
19	23.8	1·3 from 9 to 19 years.
29	51·3	2 8 from 19 to 29 years.

The annual increment increases steadily to the age of 30 years, and probably continues increasing for a considerable time beyond it.

17. *Number of trees and cubic contents of growing stock per acre.*—Regarding the number of trees and the growing stock per acre at different ages, we depend almost entirely upon Nilambur for our data. Sample areas of half an acre each were selected in each of seven plantations; each tree was measured, the cubic contents determined, and the following is the result. It is not expressly stated, but it is probable that these sample areas were all selected on alluvial soil :—*

* The length of stem to the top of sole measurement, where the head begins, of every tree in the plantations of 1844 to 1848, both inclusive, was measured by sending up a climber with a tape. In the plantations of 1858 and 1868 a large number of felled saplings were available, of which the average was taken.

The mean quarter girth was determined in the following manner:—Ten saplings were measured breast high, and in the middle of the stem at half its length, and this gave $\frac{4}{5}$ as the reducing factor. Those trees 30 inches in girth breast high were found to have a girth of 25 inches in the middle of the bole.

Name and year of plantation.	Age of plantation, in years.	Number of trees per acre.	Average length of bole, in feet.	Mean quarter girth of trees, in inches.	Cubical contents in cubic feet.		Average annual increment, in cubic feet.	
					Per tree.	Per acre.	Per tree.	Per acre.
Iravelly Kava...1844	33	120	59	9·7	41	4,879	1·2	148
Elanjerry ...1845	32	158	61	7·9	30	4,742	·9	148
Elanjerry ...1846	31	156	60	7·4	27	4,204	·9	136
Moolathamanoo 1847	30	140	62	7·5	27	3,713	·9	124
Moolathamanoo 1848	29	156	60	6·8	21	3,243	·7	112
Elanjerry ...1858	19	270	45	5·0	8	2,203	·4	116
Wallashary ...1868	9	750	40	3·4	3	2,491	·4	277

18. Colonel Beddome estimates that on alluvial soil, the Teak at Nilambur will reach maturity at from 60 to 80 years; that fellings will be spread in each plantation over 50 years; and that at the time of cutting (say at 85 years of age) the mean quarter girth will be 2 feet, the length of bole will be 70 feet, and the mean cubic contents of each tree 280 cubic feet. He also estimates that, at that age, there will only be 60 trees to the acre, making the cubic contents per acre 16,800 cubic feet.

No safe speculations can be formed regarding the future of a pure Teak forest like that of Nilambur. In its natural state, Teak does not grow alone, but is associated with Bamboos and a variety of other trees; and it is impossible to foresee the risk of damage by storms, insects, disease, or other causes to which pure Teak forests may be exposed. It may be doubted whether, even on the best alluvial soil, the average mean girth of trees 85 years of age will be as much as 8 feet. On the other hand, it is not impossible that the bole will be longer than 70 feet, and it is probable that it will be advantageous to allow more than 60 trees per acre. On page 155 of the Attaran Report of 1860, a plot in the Tsintsway forests (Yoonzaleen) is described, measuring 3,833 square feet, and stocked with 8 Teak

trees with clear stems to the first branch of 50 feet, the girth between 4′ 6″ and 6′ 5″; this would give 91 trees to the acre. Full stocked forests of Oak and Beech in Europe 130—180 years old under favourable conditions contain 120—140 trees per acre, with a cubic content (including tops and branches) of about 11,000 cubic feet. A forest of Silver Fir in the Jura, 180 years old, was found to contain 94 trees per acre, with a cubic content of 16,000 feet.

19. The total area now stocked at Nilambur is 3,436 acres, of which 1,787 are stocked with a full crop on alluvial soil, the rest not being expected to yield a full crop. In his estimate of the future value of the plantations, Colonel Beddome only assumes 6,000 cubic feet as the full crop expected on alluvial soil.

In natural forests, where Teak is associated with Bamboos and other trees, the number of the first and second class Teak trees (above 4′ 6″ in girth) rarely attains 10 trees per acre over large areas. The following are instances of forests exceptionally well-stocked with Teak :—

Date of survey.	Forest.	Area.	Number per acre.		Total.
			Class.		
			Girth above 6 feet.	Girth 4½ to 6 feet.	
1876 ...	Bimaram (Central Provinces) ...	50 acres ...	4	4·3	8·3
1870-71 ...	Pegu (Prome District) ...	17 square miles	3·6	3 0	6 6

Sketch of the flora of Rajputana.

By George King, M.B., F.L.S.,
Superintendent, Botanical Garden, Calcutta.

As might be expected from its geographical position and limited rainfall; the flora of Rajputana is not a rich one. The number of indigenous species is but small, and few of these are attractive in appearance. The province is divided by the Arvali range of hills into two unequal parts—the part to the eastward of the range lying in the basin of the Chambal, and that to the westward in the basin of the Indus. This division is, to a great extent, coincident with certain features in the physical configuration, meteorology and vegetation of the province; and these two portions may, therefore, be conveniently treated of separately. The vegetation of the dividing range itself, and of the outlying mountain mass of Aboo, so much more resembles that of the eastern than of the western tract, that it may be treated along with the former.

Eastern Rajputana.—The country to the east of the Arvali is (with the exception of the Jaipur State) more or less hilly, and has a climate and a flora resembling those of Central India and the North-Western Provinces. Where not actually hilly, the surface is, to a considerable extent, undulating. Cultivation is, on the whole, scanty, and is chiefly confined to the lower and flatter lands, while the higher parts remain to a large extent covered with their original vegetation, and on them may be found in abundance plants which, in the more completely cultivated provinces of North-Western India, are confined to the comparatively small tracts of waste and unreclaimed land.

As is the case in other parts of India with a similar vegetation, the majority of the trees and shrubs come into flower during the hot season, while the herbaceous plants blossom chiefly during the rains. Many of the latter are, moreover, annuals which wither and die as the cold season approaches. The cold season corresponds to the winter of temperate countries, and during the whole of it the aspect of the uncultivated parts of the country is brown and barren. The flowering of the shrubs and trees during the hot weather does little towards increasing the beauty of the scenery. On the contrary, it, if

anything, intensifies the feeling of barrenness and aridity. With the first fall of rain, myriads of seeds that had lain dormant in the parched soil spring into life, and in the course of an incredibly short time the whole of the country, even to the tops of the barest hills, is clad in a carpet of delicate green, while the pleasant sound of running water can actually be heard in the valleys. The largest tree of this part of Rajputana is the Semul (*Bombax malabaricum*), which on the Arvalis and Aboo attains a considerable size. The finely buttressed grey trunk, spreading arms and gaudy red flowers of this species make it a striking object in the landscape wherever it occurs. Ranking after the Semul in size are *Prosopis spicigera*, *Sterculia urens*, *Semecarpus Anacardium*, the two Acacias (*leucophlæa* and *Catechu*), *Anogeissus latifolia* and *pendula*, *Dichrostachys cinerea*, *Cordia Rothii*, *C. Myxa*, and *Phyllanthus Emblica*. These yield both fuel and building timber in parts of the region where neither is over-abundant. *Erythrina suberosa*, with its ungainly trunk and branches but handsome scarlet flowers, and the pretty geranium tree of the Anglo-Indian (*Bauhinia purpurea*), are not uncommon. *Gmelina arborea*, a tree which yields an excellent timber, and which occurs over almost the whole of India and Burma, is found sparingly in the Arvalis. The gum-yielding salai tree (*Boswellia thurifera*), so abundant in the territory to the eastward of the tract, is not uncommon in Meywar and the Arvalis. The dâk or pallás (*Butea frondosa*), which in various parts of Central India covers immense areas to the exclusion of pretty nearly every other tree, is far from abundant in any part of the region. Two Terminalias (*tomentosa* and *Arjuna*), both valuable as timber trees, occur sparingly on the eastern frontier of the tract, but are rare elsewhere. *Schrebera swietenioides*, a little-known and rather rare tree, has been found by Dr. Brandis in Meywar.

Climbing plants are not numerous, the most notable being two species of Cocculus (*villosus* and *Leœba*), *Cissampelos Pareira*, *Celastrus paniculatus*, two vines (*Vitis carnosa* and *Vitis latifolia*), and *Mimosa rubicaulis*.

The shrubby vegetation, which in every part of the region is so much more prominent than the arboreal, consists largely

of capers, jujubes, tamarisks, and *Grewias*. Of the capers by far the commonest is *Capparis aphylla*, a prickly leafless shrub with a handsome plum-like fruit, which flourishes over all the driest parts of North-Western India, and extends to Arabia, Nubia, and Egypt; *Capparis spinosa* (which yields the eatable caper) is much less frequent; *Capparis horrida*, a scrambling plant which often climbs on trees, is not uncommon; while a fourth species *Capparis sepiaria* (indigenous in the south of India), is here and there cultivated as a hedge plant. The small jujube (*Zizyphus nummularia*) is very abundant, and, covering, as it often does, large tracts of country, has great value as a fodder plant: it is also much used for hedges. *Zizyphus xylopyra* is a less abundant species, which sometimes, in protected spots, attains to the dignity of a small tree and yields a useful wood, while its bark is used in tanning. In every water-course tamarisks of several species abound. One of these (*Tamarix gallica*) is a cosmopolitan plant, which is found in suitable localities all over India and Ceylon, in China, Japan, and Siberia; specimens of it have been gathered in Yarkand, in Thibet, at 11,000 feet above the sea, and it is common in many parts of Northern Africa and Southern Europe. *Tamarix dioica*, an exclusively Indian species, is also abundant. Of the Grewias, *Grewia populifolia*, *Grewia pilosa*, *Grewia villosa*, and *Grewia salvifolia* are the common species. These all yield tough wood, which, however, is rarely large enough to be of much use; and the fruits of all four are more or less eatable. In addition to these, the most notable shrubs are *Helicteres Isora*, the curious spirally curled seed-vessels of which have a fanciful value as a remedy in dysentery: *Celastrus spinosus* and *Celastrus senegalensis*, *Buchanania latifolia*, *Cassia auriculata*, *Woodfordia floribunda* (the scarlet flowers of which are used as a dye), *Casearia tomentosa*, *Diospyros montana*, *Holarrhena antidysenterica* (named from its reputed value as a cure for dysentery), *Calotropis procera*, *Vitex Negundo* (esteemed as a remedy for rheumatism), and *Clerodendron phlomoides*. Two cactus-like fleshy *Euphorbias* (*Euphorbia Royleana* and *Euphorbia neriifolia*) occur in the hills, but are much less abundant than in the tract to the west of the Arvalis.

Bamboos are represented by a single species (*Dendrocalamus strictus*), which attains large dimensions only on Aboo and the higher parts of the Arvalis.

The herbaceous vegetation consists of *Leguminosæ* of the genera *Alysicarpus*, *Desmodium*, *Crotalaria*, *Cassia*, &c., of various widely distributed species of *Compositæ* and *Rubiaceæ*; *Boraginaceæ* being also rather numerous, and *Scrophulariaceæ* less so. During the rains a few *Convolvulaceæ* appear, and grasses and sedges are abundant.

Owing to its heavy rainfall, Aboo is, as regards vegetation, by far the richest spot in Rajputana. On the higher parts of the mountain, humid types appear which are unknown on the plains below. Most noteworthy of these is an epiphytal orchid (a species of *Aerides*) which clings to the mango trees, and in the rains produces fine racemes of delicate pink flowers. The occurrence of a charming white wild rose and of a stinging nettle (*Girardinia heterophylla*) also at once reminds the visitor to Aboo that he has left the arid region below, and recalls to his mind the semi-temperate vegetation of the Himalayas and Nilgiris. Magnificent trees of *Michelia Champaca* are found, especially beside the temples, and weeping willows adorn the margin of the lake near the station; but the latter two species have both doubtless been planted. A yellow jasmine (*Jasminum revolutum*) abounds on Goroo-Sikhur, the highest peak of the mountain; but this is also doubtfully indigenous. *Cratæva religiosa*, with its creamy yellow flowers and delicately-tinted stamens, is common on the middle and lower slopes of the hill; while *Carissa Carandas* is so abundant that during part of the hot season its pretty white flowers scent the air for miles round the station with their delicious fragrance. The prevailing tree on the slopes of Aboo is the mango. It is doubtfully indigenous and was probably originally introduced by the numerous pilgrims who have for ages frequented the sacred shrines for which the mountain is famous. Now, however, it is thoroughly naturalised, and is the commonest of the larger trees. *Pongamia glabra* is found in several of the lower valleys of Aboo (wherever it occurs on the plains below it has usually been planted) and *Sterculia colorata* is not uncommon. Shrubby and

herbaceous *Acanthaceæ* of several species abound. Very common also is *Mallotus philippinensis*, the powder covering the capsules of which forms at once a valuable dye-stuff and an efficient vermifuge. On the lower slopes of the mountain, and in the dense belt of jungle which surrounds its base, are found most of the species which are characteristic of the plains. Many of the latter (for example, *Salvadora persica*) ascend to the very highest peaks of the mountain, and thus intermix with the more temperate forms which are confined to the latter.

Of introduced Indian plants which are found usually in gardens or near villages over the whole of the eastern tract, the most prominent are the peepul (*Ficus religiosa*), the banyan (*Ficus bengalensis*), the gular (*Ficus glomerata*), the ungeer (*Ficus virgata*), the mulberry (*Morus alba*), the tamarind (*Tamarindus indica*), the mango (*Mangifera indica*), the nim (*Melia Azadirachta*), the bábul (*Acacia arabica*), the ber (*Zizyphus jujuba*), the siris (*Acacia Lebbek*), the jamun (*Eugenia Jambolana*), the mehndi (*Lawsonia alba*), the pomegranate (*Punica Granatum*), and the peach (*Amygdalus persica*). *Mimusops indica* and *Elengi*, *Ailanthus excelsa*, and *Flacourtia Ramontchi* are also occasionally met with. The bábul is quite naturalised in spots where the winter cold is not too intense, and where the sub-soil retains a little moisture: its timber and bark are both highly prized. Among fruit trees cultivated in gardens, two American species are very common; these are the custard apple (*Anona squamosa*), and the guava (*Psidium Guava*). *Argemone mexicana*, *Parkinsonia aculeata*, *Opuntia Dillenii*, and *Acacia Farnesiana* (also introductions from America), are frequently met with. *Nerium odorum*, a shrub closely allied to, if not identical with, the oleander of Southern Europe, is also common in gardens.

Western Rajputana.—To the westward of the Arvalis the country is much flatter and drier, and as the Sind and Punjab frontiers are approached, it passes into actual desert. It is, however, by no means destitute of hills, for numerous low ridges of a red sandstone rise here and there, and in other parts there are undulating areas of hardened sand. The rest of the

country is for the most part a plain of loose sand, which, everywhere more or less saline, becomes increasingly so towards the south-west, where the Loni loses itself in the Runn of Kutch. Except that they support a few of the fleshy *Euphorbias* already mentioned many of the hilly ridges are utterly barren. The little rain that falls on these bare rocks is at once carried off in rapid torrents which are often lost in the sand at a short distance from their bases. The few torrents which do succeed in carrying their water to any distance unite to form the Loni, the one river of this part of the country. But although water can be had by digging at certain parts of its bed at almost any season of the year, and stagnant pools may here and there be found at all times, it is only during the brief and scanty rainy season that anything like a continued current can be seen in any part of the Loni. The rainfall, which over the whole area is scanty and uncertain, gradually diminishes as the Sind and Punjab frontiers are approached. Erinpura, a station near the base of the Arvalis, has a rainfall of about 12 inches in the year; whereas Western Marwar, Jesulmir, and Bikanir have probably less than a third of that amount.

It must not be supposed that the Arvali range forms a rigid boundary separating two distinct floras; on the contrary, the majority of the plants already mentioned as characteristic of the eastern tracts are found on the west of the range. Near the base of the Arvalis, the soil is good and supports a belt of what would, for Western Rajputana, be a comparatively luxuriant vegetation, were it not ruthlessly preyed on by the inhabitants for fuel and timber for themselves and fodder for their cattle and camels. In passing westward from the Arvalis, such of the species already mentioned as are unable to withstand the increasing dryness of the climate, and the saltness of the soil, are represented in gradually diminishing numbers by stunted, half-starved specimens, and the majority of them finally disappear altogether. On the other hand, a few species of a thoroughly desert type gradually appear, and these latter increase in proportion to the former, until on the western frontier of the region they form almost the entire vegetation. These desert plants are outliers of the Arabian and North African

flora, and are common to all low-level Asiatic deserts, while some of them penetrate even to the comparatively high arid tracts of Central Asia. Next to the floral poverty of this tract, the most notable fact that strikes the observer is the tendency of plants, which in moister regions are herbaceous, here to become tough and shrubby, and of the whole vegetation to develop epidermal armature in the shape of hairs and thorns. The common weed (*Solanum Jacquinii*) which in the Gangetic plain is moderately covered with stiff bristles, here presents the appearance of a vegetable hedgehog. The spines of the bábul are about twice as long and as thick as they are in Malwa, while the small ber bushes, everywhere formidable, are here little more than mere bundles of spines.

The largest trees in Marwar are those that have been planted in gardens and near tanks or wells. Hardly one of any indigenous species is ever found exceeding ten or twelve feet in height. The commonest of these latter are *Prosopis spicigera Salvadora persica, Cordia Rothii, Acacia leucophlœa*, with *Acacia arabica* in the kind of spots already indicated, and *Sterculia urens* on the less barren hills. *Anogeissus pendula* and *Dichrostachys cinerea* occur but sparingly, and hardly ever exceed the dimensions of under-shrubs. Towards the Sind desert, the only tree to be found wild is said to be *Acacia rupestris*, a form almost totally absent from the eastern tract.

By far the handsomest shrub indigenous to this part of Rajputana is *Tecoma undulata*, which has the double merit of bearing large orange-coloured bell-shaped blossoms, and of bearing them simultaneously with its handsome shining leaves. This plant is so indifferent to climatic conditions that, although naturally found on some of the drier ridges of Marwar, it thrives excellently in the Botanical Garden in the steamy climate of Calcutta—a peculiarity which it shares with *Dichrostachys cinerea* and *Acacia leucophlœa*. Next to *Tecoma undulata*, the finest indigenous shrub is *Acacia Jacquemonti*, the polished stems and thorns and sweet-scented yellow flowers of which make it an object of much beauty and interest. In addition to these, the shrubby vegetation is composed of the following species already mentioned as occurring more abundantly in the eastern tract :—

Capparis aphylla and *spinosa*; *Helicteres Isora*; *Grewia populifolia, pilosa, villosa*, and *salvifolia*; the two *Zizyphi* (*nummularia* and *xylopyra*); *Cassia auriculata*; *Clerodendron phlomoides*, and *Vitex Negundo*. The tamarisks already mentioned are found abundantly in the salt-impregnated bed of the Loni, and two other species of the same family (*Tamarix articulata* and *Myricaria germanica*) also begin to be found. Both these are common in Afghanistan and in Western Asia generally; while the second of the two extends also to high altitudes both in the Himalayas and in some of the mountain ranges of Northern Europe. *Balanites Roxburghii* (a prickly scraggy shrub common in Southern India, Central Provinces, and other dry parts of India) is here pretty common. *Balsamodendron Mukul*, a shrub which yields a gum called *mukul* or *gugal*, and which extends to the dry countries far to the westward of India, begins here to be as abundant as east of the Arvalis it is rare. *Ephedra alte*, a bush common in the west of Asia and north of Africa, is said to have been found in Jesulmir. The pretty little camel-thorn (*Alhagi Maurorum*) which, occurring in the eastern tract and far beyond it in India, is also distributed in Southern Europe and Western Asia, here forms a prominent feature in the vegetation of the sandy tracts. Associated with it are a few other bushes, such as *Calotropis procera* and *Orthanthera viminea* (both of which yield an excellent fibre), and here and there *Periploca aphylla*.

Of the herbaceous vegetation, the prominent species may be indicated as follows: *Peganum Harmala* (a rutaceous plant, which is found in the Deccan and Punjab, and which is distributed to the westward along the Mediterranean coasts as far as the Atlantic) occurs in plenty in many spots, as, for example, near Palli. *Polygala abyssinica* is not unfrequent in places. The most abundant leguminous plants are *Crotalaria Burhia* (much valued for fodder) and *Tephrosia purpurea*. *Compositæ* are represented by one or two *Blumeas*, *Vernonia cinerea*, *Microrhynchus nudicaulis*, and *Berthelotia lanceolata*; here and there *Tricholepis radicans* and *Echinops echinata* are to be seen; and near irrigated spots may be met with *Machlis hemispherica*, *Sphæranthus hirtus*, and *Cyathocline lyrata*.

Not uncommon in gardens as weeds of cultivation are *Saponaria Vaccaria*, *Trianthema crystallina*, *Asphodelus fistulosus*, and *Fumaria parviflora*. Of Acanthaceous plants, the most frequent are *Lepidagathis trinervis* and *Barleria noctiflora*, with here and there two plants of wide distribution in India,—namely, *Justicia procumbens* and *Peristrophe bicalyculata*. *Boragineæ* are numerous in individuals belonging to the genera *Eritrichium* and *Arnebia*; *Trichodesmus indica* and *Tournefortia subulata* are common near Jodhpur. Several *Cleomes*, one or two *Farsetias*, two or three species of *Abutilon* and *Sida* are also common. *Tribulus terrestris*, *Corchorus depressus*, *Verbena officinalis*, *Lippia nodiflora*, *Bergia æstivosa*, *Cressa cretica*, *Convolvulus arvensis*, *Evolvulus pilosus*, *Withania somnifera*, *Solanum xanthocarpum* var. *Jacquinii*, *Salvia brachiata*, *Polygonum Roxburghii*, and *Aristolochia bracteata* are found in spots where there is a little admixture of vegetable mould, and by the margins of tanks and irrigated spots. *Amarantaceæ* are represented by *Achyranthes aspera*, *Alternanthera sessilis*, *Amaranthus lividus*, *Aerua lanata*, and *Pupalia velutina*. Such *Chenopods* as *Anabasis*, *Atriplex* and *Salsola* abound where, as towards the mouth of the Loni, the sand is highly saline. Parasitic on the roots of *Calotropis* is a pretty species of *Orobanche*. The tanks are not destitute of vegetation, for in their water may be found, though sparingly, *Vallisneria spiralis*, *Utricularia stellaris*, *Potamageton pectinatus* and *natans*, while by their margins several species of sedges, and notably *Hymenochæte grossa*, are often abundant. Several species of *Andropogon*, *Anthisteria*, *Cenchrus*, and other wiry grasses are distributed over the whole area; and towards the Sind frontier one of these, known locally as *mart*, constitutes a large proportion of the scanty vegetation. Besides this grass, the vegetation on that frontier consists almost exclusively of the small acacia tree already mentioned (*Acacia rupestris*), of a plant of the rhubarb family with curious hairy seed-vessels known locally as *phog* and botanically as *Calligonum polygonoides*, the woolly-looking plant *Aerua lanata* (locally called *bhin*), *Anabasis multiflora*, and a troublesome bur grass, *Cenchrus biflorus*.

In the sandier parts of this western tract the staff of life is derived from a rain crop of millet, which is sown as soon as a shower in July or August makes it worth while to give a hurried ploughing to the patches of soil which the inhabitants are pleased to call fields. Wheat is a garden crop confined to the small patches which it is possible to irrigate from wells. In the sands of Bikanir, water-melons occur spontaneously in such numbers as to form for some months in the year no small part of the food of the scanty population. The seeds of these and of other cucurbitaceous plants cultivated in gardens are ground, during times of scarcity, into a kind of flour.

From the preceding sketch it may readily be inferred that the country is barren and infertile, and it is difficult for one who has not visited it to realise that, in spite of its many natural drawbacks, it affords sustenance to a human population of exceptionally fine physique, and is the breeding ground of some of the finest races of cattle and horses and of the best camels in India. The bullocks of Nagore are celebrated for their size and paces; the endurance of the horses of Malláni is proverbial; while the swiftest riding-camels in India are born and bred in Bikanir. It is perfectly wonderful to see the apparently bare barren plains from which these animals contrive to pick up their daily food.

Nothing has hitherto been said of the cryptogamic vegetation of Rajputana. As might be expected, the richest spot in this respect is Aboo; but even there only about a dozen species of ferns occur, and of this small number only *Adiantum caudatum*, *Adiantum lunulatum*, *Cheilanthes farinosa*, *Nephrodium molle*, *Nephrodium cicutarium*, and *Actiniopteris radiata* can be said to be abundant. *Adiantum Capillus-Veneris* is found in a few spots, and *Botrychium virginianum* is very rare. Of mosses there are a few which, during the rains, form pretty tufts and festoons on the branches of the trees on the south-western slopes of the mountain, but at other times they are shrivelled and brown. There are a good many lichens on the trees and a few on the rocks. *Algæ* are not numerous. During the rains a good many *Fungi* spring up on decaying wood and an edible *Agaricus* is found on grassy banks; *leaf fung* are few in number.

In the eastern tract, the only ferns ever seen are *Adiantum lunulatum* and *caudatum, Nephrodium molle,* and *Actiniopteris radiata.* The latter is found only on walls, where it is associated with *Funaria hygrometrica,* the only moss at all common in the region. These species occur very sparingly, indeed, in the western tract, and only in shady crevices of rocks or on old moist walls. In wells, the maiden hair, *Adiantum Capillus-Veneris,* is occasionally met with on both sides of the Arvalis.

As has already been remarked, the province of Rajputana does not possess a flora peculiar to itself, but rather presents a field on which the adjacent floras of dry India and of the deserts of Western Asia and Northern Africa interosculate. In other words, there are, so far as the writer is aware, no species peculiar to this area, every plant in it being found also either in the adjacent provinces of Central India, Guzerat, the Punjab, North-Western Provinces, or in the dry regions of the Deccan and Southern India; while several of them occur also in countries far beyond the limits of the Indian Empire.

Extracts from the Report of the Royal Gardens at Kew for 1877. By Sir J. D. Hooker, K.C.S.I.

Boxwood.—For some years past the supply of this important wood has diminished in quantity and risen in price. It is derived from the forests of the Caucasus, Armenia and the Caspian shores. The wood of best quality comes from the Black Sea forests, and is principally shipped from the port of Poti. The produce of the Caspian forests, known in the trade as "Persian" wood until last year, was also exported through the Black Sea from Taganrog. This found its way after the commencement of the war, *viâ* the Volga Canal, to St. Petersburgh. The produce of the Caspian forests is softer and inferior in quality to that of the Black Sea. It is a matter of interest to see whether one result of the war will be to open those Black Sea forests which the Russian Government has hitherto kept rigorously closed. The falling-off of the supply has led meanwhile to various attempts to find substitutes for Boxwood for many purposes. Messrs. Joseph Gard-

ner and Son, of Liverpool, have introduced with some success Cornel (*Cornus florida*) and Persimmon (*Diospyros virginiana*) for shuttle-making, for which purpose hitherto Box has been in great demand.

Nan-mu Tree of Chinese.—Dr. Brandis has drawn our attention to a passage in Mr. Davenport's report on Yunnan [Parliamentary Papers, China, No. 2 (1877,) p. 13,] giving an account of the "Nan-mu" tree, the wood of which is so highly valued by the Chinese. If it could be accurately identified, the cultivation of the tree would no doubt be very profitable in India, and I, therefore, place on record what has been ascertained respecting it. The following is from Mr. Davenport's report:—

"This part of Yunnan (which seems to be between 25° and 26° N. lat.) produces the famous Nan-mu, so highly esteemed by the court for building purposes, and by the wealthy for coffins, on account of its durability. This timber is to be seen in perfect condition after the lapse of nearly three centuries in the shape of enormous pillars in the tombs of the emperors of the Ming dynasty, and has usually been supposed by foreigners to be Teak. The tree is tall, thin, straight growing, having no bough or twigs on the stem, but suddenly shooting out branches at the top, somewhat like a canopy over a maypole. Its bark is of a peculiar ashy grey colour, and a specimen of the leaves, gathered by myself, accompanying this report, will prove beyond all doubt that it is not a member of the Teak family.

During the Ming dynasty this wood had already become scarce (having probably been everywhere cut down and not re-planted), and was brought chiefly from almost inaccessible valleys inhabited by wild tribes. The imperial palaces at Pekin were built almost entirely of this timber.

At the present time this wood is imported into Shanghai in planks, measuring 8 feet long by 13 or 14 inches in diameter, for which the highest price is 200 dollars per plank. Whole coffins range from 100 dollars to 800 dollars.

The quality is judged of chiefly by the pungency of the scent. The leaves sent by Mr. Davenport to the Foreign Office cannot now be traced, but by the courtesy of E. Brad-

ford, Esq., late Master of the Apothecaries' Society, to which the specimens of drugs collected by Mr. Davenport were sent, I have been favoured with a further fragmentary specimen transmitted by Mr. Davenport, and also with specimens of the wood brought to this country by Wm. Lockhart, Esq., who states that "it is also used largely by Chinese gentlemen who take a pride in their libraries to make boxes for sets of volumes, and also to place between sets of volumes."

The leaves are too slender a basis for a certain botanical determination in the absence of flowers and fruits. But it appears extremely probable that the tree belongs to the family *Lauraceæ*, and the leaves themselves agree very closely with those of *Phœbe pallida*, Nees.

West Indian Forests.—Although scarcely falling within the province of this report, I cannot but record a word of warning as to the utter apparent absence of any restriction upon the destruction of the forests of the West Indian Islands, which must, as in some cases has already proved to be the cases, be injurious and even disastrous to those colonies.

With respect to Jamaica I extract, from a paper communicated to me by Mr. Thomson, the following particulars, which I think speak for themselves :—

"In certain localities hundreds of thousands of acres have been converted into desert by the wholesale destruction of the forests. In other localities hundreds of thousands of acres would, from the same cause, now be utterly unproductive, but for the interposition of foreign trees, [Logwood, Mango.]

"In consequence of the facility with which land is everywhere obtainable in Jamaica, the peasantry cut down annually 40,000 acres of forest land and thick bush on which to plant yams and other provisions. Innumerable timber trees, young and old, are thus yearly destroyed. These clearances are made in the most seasonable districts, and in many instances the excessive rainfall in such districts is perceptibly diminished in consequence of the large extent of these clearances. No conservation of the forest having ever been attempted here, the result is, as regards timber, that the resources of the island are practically nil. There is indeed some timber in the

inaccessible hills of the interior. Nearly all the timber required for building purposes is imported into the island, the annual value of which amounts to about 50,000*l.* Even the sleepers lately used for laying down the few miles of tramway in and near Kingston were imported. The unproductiveness of the island regarding timber is further to be deplored when our luxuriant tropical resources are borne in mind, and also when it is remembered that only one-thirtieth of the island is devoted to agricultural operations. In the event of any considerable advancement being made in the prosperity of the island, a very large expenditure would be entailed for the importation of timber."

The following extract from a letter received from Dr. Impray, equally seems to me to show the necessity of some forest supervision in that island :—

"*Pimenta acris,* (Black Cinnamon or Bois d' Inde), one of our most valuable timber trees, is being fast exterminated. We have no forest law, and the valuable timber trees of the island are cut down remorselessly, small and great, and of course none are re-planted. From the leaf of the *Pimenta acris* an essential oil is distilled, of which the far-famed (in America at least) Bay-rum is made. This perfume is used all over the United States. I believe there is almost a prohibitory duty on the oil, but it is smuggled into the country. Here the material will soon be exhausted, as the leaves are purchased at so much a hundred weight, and the negroes are cutting down all the young Black Cinnamon trees wherever they can get at them to secure the leaves.

Wood for Coffins in China.

It is well known that large sums are spent by the wealthy classes in China on certain rare and valuable kinds of wood for coffins. A considerable trade in woods for this purpose is being carried on, chiefly from Yunnan and other provinces of South China, northwards. Some time ago an English Missionary, travelling from Shanghai to Bhamo, met the Governor of a province on his way to Pekin, who was accompanied by strings of horses carrying planks of wood to give as presents to his

friends to make coffins. A collection of ten different kinds of woods used by the Chinese for coffins was lately sent to Kew by the Colonial Secretary for the Straits Settlements. All these woods were of the same good character, rather soft, very fragrant, and some with a fine silky grain. The prices are remarkable, ranging from a few pounds to £150. The extreme prices are almost fabulous; one case is reported of a coffin for a Mandarin, costing £600, and made entirely of wood.

One of the most valuable of these coffin woods is the Nan Mu, which grows in Yunnan, a tall tree with straight and clean stem, similar in general appearance to the wood oil trees of Burma. This tree has erroneously been identified with *Xylia dolabriformis*, the Pynkado of Burma. It probably, however, belongs to the family of Laurineæ.

The fragrant woods from Tavoy and Mergui, belonging to the genus *Cinnamomum* which were sent to the Paris Exhibition by Major Seaton, seem to be similar to some of the woods used for coffins by the Chinese, and they are again very similar to the Nepal Camphorwood, the Malligiri or Gunserai of Northern Bengal and Assam (*Cinnamomum glanduliferum*)—D. B.

On the Cinchona Plantation at Thantoungyee, S. Burma.

By the late Mr. S. Kurz.

HAVING visited last week the Cinchona plantation on Thantoungyee hill at your request, I have now the pleasure to submit to you the present memorandum.

From the few observations made with inferior instruments, the temperature appears low enough, although the place lies only about 3,800 feet above sea, to guarantee the growth of Cinchona at Thantoungyee. The atmosphere, however, will turn out to be too dry during the hot season. This is fully confirmed by the vegetation that covers these ridges. The forests there are evergreen forests, belonging to the variety, which I designated in my letter to the Conservator of Forests, British Burma, dated 29th May 1868, as UPPER DRY FORESTS. They consist chiefly of *Schima Noronhæ* and *Sch. oblata*,

Myrica Nagi, *Albizzia stipulata*, *Helicia robusta*, *Quercus dealbata*, *Eurya japonica* and one or two other species, *Garcinia anomala*, an arboreous *Saurauja*, *Pyrenaria camelliæflora* in abundance, *Ternstroemia japonica*, *Anneslea monticola*, *Calophyllum spectabile*, *Pithecolobium sp.* (near *P. angulatum*) and another leguminous tree only found in leaf but very similar in habit to *Albizzia lucida*, *Dillenia aurea*, a probably new species of *Castanopsis* in great abundance, *Bischoffia javanica*, a large-sized bamboo called 'Kyellowa,' *Beilschmiedia*, *Turpinia nepalensis*, two arboreous species of *Araliaceæ*, *Podocarpus neriifolia* and a few other trees in less abundance. Along the choung appear a splendid *Livistona* and *Pandanus furcatus*, the latter in large number. Of creepers and climbers are especially seen—*Mucuna macrocarpa*, *Rubus rugosus*, a climbing berry-bearing bamboo, here called 'Wathabwot,' but different from the one so named in the Pegu Yomah, three or four species of *Vitis*, amongst them an *Ampelopsis*, a fine *Calamus* possibly new, with the leaves white underneath, *Smilax lancifolia*, a *Bauhinia*, *Cnestis ignea*, *Lygodium polystachyum*, *Stenochlæna scandens*, etc. The undergrowth is chiefly composed of *Areca triandra*, *Melastoma malabathricum*, *Wallichia caryotoides*, *Maesa ramentacea*, a species of *Camellia*, *Tabernaemontana*, *Psychotria*, *Leea Staphylea* (?), a *Wendlandia*, etc. The herbage covering the dry ground is composed of *Strobilanthes Brandisii*, and locally of *St. pentstemonoides*, *Peliosanthes macrophylla*, *Tupistra nutans*, *Ophiopogon*, *Carex*, *Commelyna obliqua*, *Polygonum chinense*, a large *Phrynium*, *Alpinia nutans* and some other plants now without flowers or fruits, a species of *Pollinia* locally forming pasture grounds, *Dianella*, a large *Osbeckia*, *Molineria recurvata*, a fine large *Begonia*, *Lepidagathis*, and a number of ferns such as *Pteris aquilina*, *Aspidium*, *Nephrodium* and *Gymnogramme decurrens*. The stems of trees are but sparingly covered by mosses, but rich in cortical lichens, and, at my visit, were a good deal dried up, even as the *Hymenophylla*, *Xyris Wallichii*, *Asplenium laserpitiifolium*, *Niphobolus* and *Pleopeltis*, which are found frequently along with them. On granitic rocks, *Xyris Wallichii*, *Sonerila seccunda* and *Didymocarpus mollis* are frequently seen. The ground is, during the hot season, densely

covered by dry leaves, &c., and jungle-fires enter these forests with as much facility as they enter the leaf-shedding forests of the lower regions. In fact, a large jungle-fire that broke out during my stay at the plantation, has shown me fully the destruction to which these forests are subjected during the hot season. The devastation by fire here is quite equal to that experienced in the plains, and where the large bamboo prevails even more fearful.

The soil is a light red soil, no doubt the result of decomposition of felspar of granitic rocks, with a great preponderance of rather coarse quartz-sand. The surface-soil is only to a very small depth, nowhere exceeding a foot, discoloured either by the decomposition of vegetable parts, or by the ashes of burnt-down vegetation. Huge rounded granitic rocks are seen here as everywhere in the Karen hills, striking out from the ground, or lying loosely on or along the ridges, or carried down to the choungs.

I should think that the locality was an excellent one for the cultivation of tea, and I am still more supported in my belief by the fact that nearly three-fifths of the forest trees forming these jungles are of the same family to which the tea-plant belongs, *viz.*, *Ternstræmiaceæ*. Besides, a species of *Camellia*, most probably identical with the Assam tea-plant, is found here plentifully along the Paloun, a choung which flows through the Cinchona plantation. But not a single kind of *Rubiaceous tree* was observed by me during my few hours' ramble through the surrounding forests.

The Cinchona will, no doubt, thrive here; but the question is, whether the cultivation at this place will really turn out remunerative. The trees will attain the same height and growth as the trees now composing these forests, that is, they will remain stunted and branched. Meanwhile, should they be planted along a choung in a deep alluvium, resting on primary rocks, it would cause the plants to grow up to be large-sized trees. It is for the latter reason that I should give preference to a formerly selected locality at Plumadoe, although I admit that the absolute elevation of Plumadoe valley is not sufficiently high (only about 2,200 feet). In my opinion, Cinchona would

thrive best in those forests, which I have mentioned in my letter to the Conservator of Forests above alluded to, as UPPER MOIST FORESTS, occupying the valleys and north and north-east faces of ridges, at elevations from 3 to 6,000 feet. The absolute height and depression of temperature caused by it are of little value, if not accompanied by a corresponding degree of dampness of the atmosphere. Nor is it absolutely necessary to go so high up the hills to obtain a temperature suitable for the cultivation of Cinchona. In fact, it is well known, and all my observations in Burma and elsewhere in India have taught me that valleys are much cooler and moister than ridges and summits of hills; so much so that, for instance, the temperature of Bogelay village at 3,000 feet elevation is more than 3 degrees higher than that of Palawa Zeik in Toukyeghat, hardly 500 feet above the sea. Unfortunately, there are no complete thermometrical observations at my disposal, either of Thantoungyee or of Plumadoe valley which could enable me to compare these two localities from a climatological point of view.

Dated Camp Otdweng, Toungoo, the 26th April 1871.

The function of the Pines and the Larch in the Production of soil.

(*Continued from page* 187.)

OF the three species of Pine which, in Europe, are found in cold climates—one, the *Pinus sylvestris,* is widely distributed; the other two, *P. montana* and *P. Cembro,* are very rare. The Larch is associated with these Pines either towards the pole or on lofty mountains.

The most important of the European Pines is, undoubtedly, the *P. sylvestris,* or 'Northern Pine,' known also by other names taken from the different localities in which it occurs, such as 'Auvergne, Briançon, Haguenau, Riga, Scotch or Norway Pine.' It is easily recognized from some distance by its ashy green-grey foliage, the colour of which is caused by the short light-coloured needles. The cones and the bark of the base of the stem have also a grey tint, but the higher portion of the bole,

and the point from whence the branches proceed, are distinguished by the characteristic bright red colour of the bark. This Pine is remarkable for the widespread area of its distribution. Found both in the plains and in the mountains, it advances from the extreme north of Europe to the southern regions, from the Icy Sea to the Mediterranean. On the Baltic Coast it forms, so to speak, one immense forest of 50 millions of hectares. As much again is found on the plateau of Central Russia, and the range of the tree extends thence beyond the Ural Mountains into Upper Siberia, so that it may be called the tree of the Northern deserts. In the valley of the Danube it is only met with in the mountains; in the Alps it is sometimes found at great elevations on southern exposures, owing to the protection afforded by the great mountain chain; in the Pyrenees it still forms forests at 1,500 metres, rising gradually thence to 1,800 metres, and extending itself westwards into the Basque region. Thus, passing from the north to the south of Europe, the elevation of the station of this Pine rises gradually, and seems in each region to be comprised between extreme altitudes of about 600 metres apart. Taken as a whole, the area of the home of the *Pinus sylvestris* presents the figure of a vast ellipse, having its centre in Russia, its greater axis passing between Moscow and Berlin, and its lesser axis extending from Lapland to the Black Sea. It is, however, restricted to poor soil, and especially to silicious sand.

In such a soil, the conditions of vegetation are difficult, and few forest trees can easily accommodate themselves. Unmixed with other species, the vast northern Pine forest, the 'bör' of the Russian plains, has a peculiar and wonderful appearance; the forest mass thin and with scattered trees is open on all sides to the light; and the soil, arid or peaty, only covered with dead pine needles, or with a carpet of bilberry and heather bushes and long thin erect-stalked grasses. Further south the Pines are mixed with Oak and Birch, the white bark of the latter forming a vivid contrast with the red boles of the Pines, and the brown oak trunks. In these forests animal life is scanty and silent, the presence of roedeer or the woodpecker here and there met with only serves to render the profound solitude more striking.

In mountain localities the Pine is often found in company with the Birch and the Silver Fir; these trees, by the thick cover they give, preserve the freshness of the soil, while the Pine, with its light foliage, overcovers them and thus forms trees of splendid form and magnificent bole.

The Scotch Fir requires abundant light for its growth. In the northern regions, where the summer nights are very short, it has full light almost without break during the season of vegetation; in the almost rainless plains of the Volga the dry pure air permits a strong light to reach the ground; and in the mountains of France it is found on southerly and westerly slopes, facing the Beech, the Silver Fir and the Larch, which usually cover those towards the north and east. Of all our forest trees, it is the one which best resists wind, provided it is not constant and cold, provided it is not damp.

In form the Scotch Fir varies exceedingly; it nevertheless is always *a tree* and never degenerates into a bush as do the Beech, Spruce, Birch and Mountain Pine. Even in Lapland, on the Tana, the most northern river of Europe, beyond the 70th parallel of latitude, it still forms trees capable in size of furnishing building timber, but still varies much in shape from the short, knotty, much branched and gnarled tree to the lofty mast-like straight growing Pine, whose summit ends in a narrow cone with only thin short branches.

Trees of this type, however, are always exceptional, even in suitable localities, and fine specimens over three centuries in age and capable of giving first-class mast timber are no longer seen. The type of tree, too, seems destined to disappear from the forest of Europe, where it formed such a magnificent spectacle of vegetable growth, but a few fine young trees of it are still to be seen in certain localities, such as in Italy and at Pustelnik in Galicia.

The best forests of *P. sylvestris* which France possessed were lost with Alsace-Lorraine. In the central plateau only a few still remain, such as are seen in the gorges of the Allier, although the mountains of Auvergne might easily be covered with them. A few fine trees may still be found in the Alps, but they are getting rarer and rarer every day in the forests of Provence,

Dauphiné and Savoy. In the Pyrenees the Scotch Fir is rarely found except as isolated trees; however, in the valley of Capsir, at an elevation of 1,540 metres, on the banks of the Aude where there is merely a small brook, surrounded by lofty mountain crests which shelter it on all sides, is an almost pure forest of Scotch Fir called the forest of Mattemal. In that station, on a platform of diluvium forming a terrace on the banks of the Aude, may be found trees of two hundred years of age, with a diameter of 0·65 centimetres, and stems capable of giving 17 metres of building timber. On this little plain, cut off from the plains of France by the still inaccessible gorges of the Aude, the trees have but very slight value, but great utility; the wood cannot be extracted, and without trees the country would be uninhabitable.

The *Pinus montana* is first found with the Scotch Fir in the forest of Mattemal in the Pyrenees, and it is also in that region found on the granitic slopes of Capsir, Roussillon and Cerdagne round Mont Louis. In the Alps, as in the Pyrenees, its home is at an elevation of 2,000 metres, but its elevation varies from 400 to 500 metres lower to the same amount of higher altitude, provided it is in favourable localities. It is not possible to mistake this Pine, whose bark is uniformly grey, from the Scotch Fir which has invariably some shade of red on the stem, or at any rate at the point whence the branches begin to spring, and merely from appearance there is no difficulty in distinguishing them, for the Mountain Pine is a tree of an aspect quite different from that of the Scotch Fir, being erect, pyramidal, with numerous close short branches, growing slowly, and rarely reaching any considerable size. In the Alps it is called *suffin*, and a tree of 40 to 50 centimetres in diameter is considered a fine specimen, though sometimes, as in the communal forest of Lian in Cerdagne, a larger size, and sometimes even double, is met with. Either above or below its proper locality this Pine degenerates and becomes deformed. On the uncongenial soil of torrential deposits on which the Mountain Pine is sometimes found at the bottom of valleys, it degenerates into a bush or rather a mass of thin closely-formed stems, and this is the form which has been called *Pinus Mugho*. At the upper limit of forest vegetation,

and especially on the northern slopes of the Swiss Alps, it is found growing prostrate or trailing over the ground, which in this way it shelters well enough, and from which circumstance it is called *zwergkiefer* or *legfohre*, the 'branching' or 'prostrate' Pine. Botanists have also called it 'Pin à Crochets' in consequence of a curious sport of the scales of the cone which are often curved back in the form of a hook. The cone of this Pine is also distinguished by its shining surface from that of the Scotch Fir which is grey and not polished.

The foliage of the Mountain Pine is also of a much darker green than that of the Scotch Fir, and this difference of tint permits us readily to distinguish from a considerable distance, often of several kilometres, the horizontal line which separates the two species in the same hill side where the Scotch Fir covers the lower, and the Mountain Pine the higher slopes, the latter usually higher than 1,700 metres. Besides the localities in France the Mountain Pine occurs also in some places in the Carpathian and Sudetian Hills, and in the Caucasus. As regards soil, it has no special predilection, as it may be found equally in limestone or sand, in dry soils or in marshy bogs, sometimes it appears, being then more or less of a botanical curiosity, accompanied by a few miserable stunted Birches, in the great masses of high regions, such as the Jura, the Vosges and the Black Forest, at a considerable distance from the original localities where its growth is abundant.

(*To be continued.*)

Wattle-Tree Cultivation.

A CORRESPONDENT, who a short time ago sent us his views on Tasmania as a place of settlement for Anglo-Indians, writes :—

"When on a visit to Kodi-Kanel, a few months ago, I was much struck at seeing how deeply-rooted the 'Wattle Tree' had become. The curse of this tree is well known, particularly in Tasmania, where one can see hundreds of acres of valuable cultivable land crowded with wattle, which nothing will kill, except dragging them up by the roots when they are young, care being taken that the root is not broken. The process of

grubbing up the young wattles is an expensive and tedious one. The earth round the roots must first be loosened by the use of a pick, then a horse or pair of bullocks are chained on to the butt-end of the tree, and drawn in the direction the root is growing. In this manner, roots 15 to 20 feet long, carrying on an average, a young tree to every foot of root, are dragged out without being broken.

"It may not be known by many, who are now doing their best to destroy the wattle, that the bark of that tree is most valuable for tanning purposes. When the discovery was first made some eight years ago in Tasmania, quite a rush was made in all parts of the country by speculators from Hobart Town and Launceston, who bought up all the wattle shrubs from the squatters, who were glad to sell the bark at five shillings an acre; and in the course of three years, the speculators were glad to buy the bark at £2 an acre. The process of stripping the trees simply requires a ring to be cut into the wood at the butt-end of the tree, when the bark is pulled off in strips by a number of boys, who are able to climb up the tree, so as not to break the strip, and also to strip the tops of the trees, where the best bark is to be found. The strips are tied in bundles by women, and stocked in certain small depôts by men, where the bark is left for some time to dry in the sun. It is then carted away in large six-horse waggons to either of the two towns, where it is crushed at the steam mills; and eventually a large quantity is shipped to England and the other colonies. At present the bark is worth as much as £5 a ton—so that it is not only a source of revenue to the farmer as long as he has trees to strip, but in another respect; the bark having become valuable, has been the cause of his being able to get his land cleared for little or nothing; because, as the stripped trees generally die, the contractors are made to cut them down; they are then heaped in large stocks, and when thoroughly dry are burnt; whereas, perhaps, for years, the farmer has seen his land gradually becoming a wattle scrub, the growth of which he was unable to cope with. In Victoria, in consequence of the cheap and abundant supply of wattle-bark, now acknowledged to be by far the most powerful tanning bark in the world, the export

in leather trade has within the last seven years largely increased. The exportation of hides has nearly ceased, while the number imported during the seven years were 392,228. The total value of leather exported during the seven years was £1,532,703, exclusive of the amount required for consumption in the colony. In 1870, the amount of bark exported was only 1,384 tons, representing £6,418, while in 1876 the exportations amounted to 9·724 tons, the aggregate value being £60,386. As the wattle tree grows very quickly, and seems to flourish so remarkably well at Ootacamund and Kodi-Kanel, it would be worth Government's while to try an experiment at plantation, on the formation of which the following few suggestions may be useful :—

"There are three species of wattle, namely *A. pycnantha*, commonly known as 'broad-leaf,' 'golden,' and 'green;' *A. decurrens*, or black wattle; and *A. dealbata*, or silver wattle. The bark of the first is superior to any other, but the tree is of slow growth, and does not attain such large dimensions as the black and silver species. For tanning purposes the silver wattle is generally discarded. The black wattle is of vigorous and robust habit, and for commercial purposes is equal to the broad-leaf species. September, October, November, and December ought to be the stripping season. In all cases 'stripping should be thorough, as the higher branches often carry the best bark, and under no circumstances should any bark be left on the tree.' The wattle requires little attention in cultivation. Its wood can be readily utilised for cask staves, axle spokes, axe and pick handles, and many other articles requiring a tough, durable grain, and when dried it is an excellent firewood. A good profit also may be derived from the sale of the gum which exudes from the trees which yield a percentage of tannin, but they can never replace the wattle. The bark from trees growing on a limestone formation is greatly inferior in tannin. One of the largest black wattles met with gave a mean diameter of 24in., its age being 18 years. The wattle is at its prime at 10 years. After that the tree loses its vigorous, healthy habit, and is usually attacked by disease or insects.

"Wattles grow on almost any soil, but their growth is most rapid on loose sandy patches, or where the surface has been broken for agricultural or other purposes. Where the soil is hard or firm, it is recommended that plough furrows should be made at regular distances of say 5ft. to 6ft. apart, into which the seeds are to be dropped. The outer covering of wattle seed is peculiarly tough, hard and horny in character, thereby forming a protection which renders the seed comparatively impervious to ordinary germinating influences. It will, therefore, be found necessary to employ a more direct agency than simply covering the seeds with earth. Water, of a little less than boiling temperature, should be poured on the seeds, and they may then be allowed to soak in the water until soft. As the seeds are small, and ought to be sown near the surface, a very light sprinkling of earth will suffice. It would be sufficient for all practical purposes of cultivation to drop the seeds at average distances of 1 foot apart along the furrows, in which case about 7,200 seeds would suffice for an acre of land. The wattle seed is, however, inexpensive, being obtainable in most districts for the mere trouble of collecting, or it can be purchased for 8*s.* or 10*s.* per lb. There are about 40,000 seeds of the *Acacia decurrens*, or black wattle, to the lb., while the seeds of the *Acacia pycnantha*, or golden wattle, are one-fourth heavier, and consequently represent not more than 30,000 to the lb. The seeds can, therefore, be dropped along the furrows at much shorter distances, and the seedlings thinned out at discretion, whereby the chances of a regular plantation would be increased. On loose, sandy soil, on which *Acacia pycnantha* can best be raised, it might not be even necessary to break up the soil in any way; but it should be borne in mind that any opening up of the surface would materially accelerate the germination of the seed and subsequent growth of the seedlings. On such open sandy soil the straight furrow line may be dispensed with and the seeds scattered broadcast. When the young trees have attained the height of three or four feet, the lower branches should be pruned off, and every effort afterwards made to keep the stems straight and clear, in order to facilitate stripping, and induce

an increase in the yield of bark. In all instances where attention is paid to the cultivation of wattles as a source of income, care should be taken to replace every tree stripped by successional sowings, in order that there should be as little variation in the yield as possible."—*From the 'Madras Mail,' October* 18, 1878.

The Forests of Cyprus.

From "Gardeners' Chronicle" of July 27th, 1878.)

As already stated, some writers who profess to write for the public information have imagined forests of Pine, Beech, &c. Unfortunately forests of any kind of tree are exceedingly limited in area, and chiefly confined to the inaccessible parts of the mountain chains; and as for the Beech, there is no record, we believe, of its ever having been found in the island.

Formerly, it is true, Cyprus was covered with forests, and was noted for its excellent timber; but according to Unger and Kotschy there is no doubt that then, as now, the forests consisted principally of Pine trees. From the sea-level up to 4,000 feet *Pinus maritima* prevails, and above that altitude it is replaced by *P. Laricio var. Poiretiana.* Even now it is possible to trace the earlier distribution of these two Pines, and see that the Pine forests were only interrupted here and there by other trees. Although the work of devastation has been carried on very recklessly, there still exist some beautiful though thin forests of *P. maritima. Europhaca boetica* flourishes only in the shade of this Pine, and *Quercus alnifolia, Arbutus, Andrachne,* and *Acer creticum* are often associated with it as underwood, sometimes straying beyond and forming independent copses. The forests of *P. Laricio* are nobler and undisturbed, because they are in less accessible situations. This Pine clothes the heights of Troodos, Adelphos, and Machera, and these alone. Few flowering plants flourish underneath the Pines. One of the most conspicuous is the beautiful *Pæonia corallina,* and *Limodorum abortivum* pushes forth from the decaying bed of Pine foliage. *Juniperus fœtidissima* is associated with the Pine on and near the summit of Troodos, to which also *Berberis cretica* penetrates. Only the

two species of Pine named occur in the island. *Cupressus horizontalis* and *Juniperus phœnicea* are rapidly disappearing as forest trees, though the latter spreads as a shrub where the maritime Pine makes room for it. *Quercus inermis* and *Q. Pfæffingeri var. cypria*, the only arborescent species of Oak, are now quite rare as trees, and can never have had any considerable distribution in the island. *Platanus orientalis* and *Alnus orientalis* exist only by the side of the beds of streams; and *Cratægus Aronia* and *Pistacia palæstina* are rapidly disappearing, fine specimens being quite rare. The general character of the flora is quite Mediterranean, as distinguished from Syrian. One of the most noteworthy features in this is the prevalence of needle-leaved trees in Cyprus, whereas in Syria these are re-placed by flat-leaved trees. A considerable proportion (4·2 per cent.) of the species are peculiar to the island, at least they have hitherto not been found elsewhere. Of these, eleven are *monocots* and thirty-one *dicots*—two *apetalæ*, sixteen *gamopetalæ*, and thirteen *polypetalæ*. Amongst the most noteworthy are *Quercus alnifolia*, which represents *Q. Ilex; Q. cypria, Ballota, integrifolia*, a spiny species; *Pterocephalus cyprius, Salvia cypria, Galium suberosum, Ornithogalum pedicellare, Silene lævigata, Gladiolus triphyllus, Colchicum Troodi, Crocus cyprius, C. veneris, &c.* The bulb flora, it may be repeated, is still very imperfectly known.

Bamboo as a Paper-making Material.

TO THE EDITOR OF THE "INDIAN FORESTER."

DEAR SIR,—I have only just received your Journal for April, and perceive you have kindly inserted therein my letter on Mr. Smythies' experiments on Bamboo in the Central Provinces. From fortuitous circumstances, due mainly to Bamboo being a tropical product and failing supply, I regret to say I have been unable to progress much further in experimenting on its manufacture into "Paper Stock," the long-continued commercial depression being deterrent on any new enterprise in India. I am, however, daily looking for an arrival

of some thousands of stems collected for me by Government in Burma to be crushed at Rangoon by the rolls I sent out, and also some few tons from Jamaica collected for me by Mr. Robert Thomson, the author of the letters I inserted in the Society of Arts' Journals of January and March last.* I mail you herewith, and you will confer a favor if, to keep this important subject alive and promote discussion and attention, you will insert their letters in your next issue.

Mr. Thomson is again in England, and his further investigations more strongly confirm the conclusions therein referred to: placing the cheap and continuous supply of this valuable paper-making material beyond dispute, and as I venture also to add that my experiments so far have proved its value as regards quality for the purpose, I hope ere long to find the subject will acquire the importance in our great Indian Dependency which I think it merits. In the persent somewhat hazy condition of European politics, not merely speaking selfishly, but in the interests of our English Paper Trade, I think it will be admitted it would be better we should draw our supplies of raw material from India than be dependent as now almost entirely on Esparto grass, the quality of which I may add is getting less and less reliable.

That judiciously and economically carried out the manufacture of paper stock from Bamboo will pay, and pay well, I confidently assert.

I will not fail to send you samples of the paper and paper stock from the Bamboos now in transit to our works so soon as they arrive, and remain meanwhile,

Dear Sir,
Faithfully yours,
THOS. ROUTLEDGE.

CLAXHEUGH SUNDERLAND,
17*th October* 1878.

* The first addressed to Sir Joseph Hooker, the second to Mr. Routledge.

CINCHONA PLANTATIONS, JAMAICA;
6th November 1877.

DEAR SIR JOSEPH,—I have thought of writing you for some time on the subject of your remarks, in your last annual report on Kew-gardens, on bamboo as a material for paper-making. I hope you will excuse the liberty I now take in submitting the views I entertain on this subject. I have taken much interest in this matter, and have been in communication for some time with the largest firm of paper exporters in America, with the object of establishing the export of the raw material from here on a large scale. I have also from time to time, in my reports to the Government, referred to bamboo as being one of the most important paper-making materials. And I may further mention that both the *European Mail* and the *Planter's Gazette* have recently noted the encouraging prospects that exist in Jamaica of establishing a large export trade in bamboo.

Cutting the bamboo stems *en masse*, as you have stated, would undoubtedly destroy the plants; but, with great deference, I would remark that this destruction of the plants can be effectually prevented by the adoption of a different process of cropping. Thus, instead of cutting all the stems simultaneously, a given proportion of matured stems should be retained, and this need only be a small proportion, sufficient to maintain the vigorous action of the roots. The stems thus retained for the preservation of the fructions of the roots may even be moderate in size. Indeed, they may be lopped so as to superinduce the sprouting of branches and foliage near the ground. Another point to be observed consist in the manner in which the young, succulent stems are cut. They should be cut—that is, the crop for making paper—not close to the ground, but a few nodes above the ground should be left. This plan ensures the sprouting of branches and foliage from some thus left, and maintains the unimpaired action of the roots.

The continuity of supply of the bamboo by the adoption of this plan aggregated to a very considerable quantity each year; and, as has been seen, a bamboo plantation may be kept up indefinitely in regard to time.

I have seen three tons of full-grown stems obtained from a bamboo clump, covering only a few square yards. This would be an enormous quantity per acre. By the system of cropping which I propose, each succulent stem, in that condition in which a penknife is easily passed through it, when dried averages only about three pounds in weight. As many thousands of these are obtainable per acre annually, I feel sure that some ten tons of paper stock could be procured from each acre annually; putting it even at the half of this, the cultivation would prove highly remunerative.

The system of reserving a due proportion of growing stems, by which systematic thinnings would be constantly obtainable, is so obviously advantageous, that I think it would entirely supersede the plan proposed by you, namely, growing bamboo like the sugar cane, and to replant after cutting the crop. Bamboo cuttings, though they root immediately, require to be planted a long time, certainly over two years, before they produce large and vigorous stems suitable for paper making.

It is a pity that some method could not be devised for utilising the ripe bamboo stems in paper manufacture. Some years ago hundreds of tons of the ripe stems were exported from here to America, which stems, I have been informed on reliable authority, were made into paper; this trade was brought to a close owing to some difficulties in the monetary affairs of the merchant in New York to whom the bamboo was consigned. An almost incredible quantity of ripe bamboo is procurable from each acre of land, and I find that the ripe bamboo is used in China for paper manufacture. In a most interesting "Catalogue of the Chinese Imperial Maritime Customs," collection of products at the Philadelphia Exhibition, published by the authority of the Inspector-General of Chinese Maritime Customs, the following account is given of the process of treating the bamboo stems:—"The method of preparation from bamboo is as follows: The bamboo is stript of its leaves and split into lengths of three or four feet, which are packed in bundles and placed in large water tanks; each layer of bamboo is then covered with a layer of lime, water is poured on till the topmost layer is covered. After remaining in this

condition three or four months, the bamboo becomes quite rotten, when it is pounded into pulp in a mortar, cleansed and mixed with clean water. This liquid is poured in quantities sufficient for the size and thickness of the sheets required, upon square sieve-like moulds. These sheets (of which a skilful workman can make six in a minute) are allowed to dry, then taken from the mould and placed against a moderately-heated wall, and, finally, exposed to the sun to dry. The best quality is made from the shoots of the bamboo, with alum added to the infusion; the second from the bamboo itself, though a higher grade of this quality is attained by the previous removal of the green portion."

I would add that the prices of paper made from the bamboo in China range from 3 dols. 61 cents. to 21 dols. per *pecul* (133⅓ lbs.).

I remain,
Dear Sir Joseph,
Yours truly,
ROBERT THOMSON.

To SIR JOSEPH HOOKER, F.R.S.,
Director, Royal Botanical Gardens,
Kew.

DEAR SIR,—With reference to your letter of 30th December last, addressed to me in Jamaica, and which I only received a few days ago, it having been returned to me here from Jamaica, I beg to submit my further views on bamboo cultivation.

Jamaica has a very striking variety of climates in the lowlands more or less suitable for bamboo growth. This variety of climates has been caused by the improvident destruction of the forest. Bamboo on the drier plains presents a shrivelled and stinted aspect, except when within reach of water, which ensures its wonted luxuriance, it therefore assumes its greatest luxuriance in the most humid districts. Many hundreds of acres of certain districts are densely covered; for instance, a certain part of the parish of St. Thomas is literally covered with it. The plant flowers and yields seed in Jamaica under

very exceptional circumstances, so that seeds are rarely seen. I have never been fortunate enough to see it in flower. It has been widely distributed owing to the readiness with which cuttings grow in most climates. The ripe stems are commonly used to form fences, the post and rails consisting of the stems; the posts, if placed in the ground prior to the rainy season, take root, and unless they are frequently trimmed become irrepressible thickets. Ripe stems of medium size are not uncommonly used by the Negroes as poles on which to support each plant of Yam, which climbs over the pole in their cultivated "provision grounds;" these stems in like manner grow. This will explain the facility with which the plant is propagated—though it is likewise propagable by offsets or rhizomes, I think, however, the stem process of propagation would be in every respect preferable.

With regard to the question as to the period required to produce "crops by planting," I am quite sure that this period could not be diminished by planting offsets from established stools. It should be remembered that by any system of propagation of the bamboo, the first process of rooting is very simple; the result of the first roots is the production of slender, twiggy shoots, but as these latter become matured, the increased vigour of the root action creates stems with proportionately increased strength, and so on step by step until the fully developed stems are producible; the whole length of time, from the time of planting, as I have already mentioned, for the maturation of the crop being at least two years.

An individual stool, if influenced only by the ordinary rainy seasons, I think would not produce more than one crop in a season, but under a system of irrigation I am strongly inclined to believe that two crops would be producible. For the wants of the paper manufacturer it will no doubt be supposed that the available command of bamboo obtainable may be turned to account, instead of having resort to the formation of plantations. I will, however, briefly endeavour to show that a regular plantation possesses immense advantages. The existing bamboo, though only a few miles from shipping ports, is not so conveniently situated as it would be in a special plan-

tation, on which the most advantageous and accessible spots would be set apart and systematically planted in a series of plots, in order to facilitate and economise cutting and carriage. The advantages thus indicated would be considerable, but the great advantage of planting bamboo would be that of having it brought under the influence of irrigation, as it is peculiarly a water-loving plant.

It is well known that general crops of bamboo shoots are only produced after heavy rains, a fall of from 15 to 30 inches; such rains usually occur two or three times a year in Jamaica; the time young shoots take to spring from the ground up to about 25 feet (they are at this height in a fit condition for your requirements) after such rains averages five weeks. Irrigation would produce constant action at the roots, and there can be no doubt that by the process of cutting, which I advocate (*vide* my letter of the 6th Nov.), several crops a year may be secured; indeed, a continuous succession of cropping could be assured by systematic cultivation and irrigation.

To those who have not visited the tropics it is impossible to conceive the extraordinary luxuriance of this gigantic grass. The description you give in your valuable pamphlet is far short of its majestic grandeur.

In laying out a plantation, I think that cuttings should be set about four or five feet apart; thus by planting thickly the intervening surface would be expeditiously occupied by the stools, and this system ensures the benefit of fostering among the plants a reciprocal tendency to shoot upwards.

The cost of planting would be about £2 per acre. After planting, four or five weedings, costing ten shillings, would be given during the two years required to establish the plantation. Subsequently to this cultivation would be absolutely dispensed with, except the application of water and a judicious system of cutting out the stems.

The Government of Jamaica has constructed, at great expense, magnificent irrigation works on the St. Catherine Plain, surrounding Spanish Town, and as very little advantage has been taken of this precious adjunct to tropical agriculture, land is obtainable at a very cheap rate, and it is most conve-

niently situated, as the railway connects it with Kingston, only 15 miles distant.

The irrigation works are constructed to irrigate upwards of 14,000 acres, but only a few hundred acres of cultivation have actually been brought under the influence of this water. Labour would be abundantly obtainable at 1*s.* 6*d.* a day; hundreds of strong Negro labourers would be at command all the year round, and for rough and continuous hard work the Negro is far superior to the coolie, and they prefer any kind of work to sugar estates work.

The Government undertake to supply a quantity of water (as I mentioned in a previous letter to you) equivalent to a rainfall of 60 inches a year for £1 per acre per annum; this is very moderate, as it would certainly double or treble the crops of bamboo annually as compared with the ordinary seasons. The average rainfall of the locality in this irrigation scheme is about 40 inches.

Our bamboo is *Bambusa vulgaris*, but, of course, you are aware that all the varieties are most productive in localities in which moisture is most abundant. This is a most important consideration, in view of the production of bamboo in Jamaica, and one which has, perhaps, not received any attention; the variety of climate as regards moisture is very remarkable. The destruction of the forest in most parts has materially lessened the rainfall; certain districts are too dry for bamboo to exist in, others only afford sufficient moisture to maintain the bamboo in a condition of very partial luxuriance; it therefore follows that districts having a constant precipitation of rain, with a normal average of from 80 to 100 inches a year, are best adapted for this plant. Astonishing crops under irrigation, therefore, would be obtainable at a small cost of production, for it would require little or no cultivation beyond its first establishment.

I agree with you that it would not answer to export the bamboo in any other way than manufactured into paper stock, not only on account of the great difference in the cost of transport, but owing to the deterioration of the article in tran-

sit, when it is sent in a crude state, due to the difficulty in drying the young stems, even after crushing.

I may mention, that before your pamphlet was published I was impressed with the notion that bamboo was destined to become the most valuable of all materials for paper-making, by reason of the quantity of it producible per acre—a quantity of fibre far greater than can be produced from any other plant, a fact to which you have referred. It should be remembered that bamboo grows its whole height in a few months, that the great bulk of it is composed of fibre which is convertible into paper stock, and that it produces its stems so closely, that is to say, each stem about 60 feet high (*Bambasa vulgaris*) occupies about half a square foot. Thus it does not require, as you state at page 8 of your pamphlet, two feet; half a dozen at least grow within two feet. Indeed, I should scarcely like to say what quantity of bamboo may be realised per acre, but it may be safely predicted that it will be so large that it will revolutionise the paper trade.—Remaining yours truly,

ROBERT THOMSON.

11, QUEEN-SQUARE, BLOOMSBURY, LONDON,
22nd February 1878.

Forestry at the Paris Exhibition of 1878.

Exhibition of objects relating to the reboisement of mountains and the treatment of torrents.

THE Forest Administration, when called on to execute the law of 28th July 1860, and that of the 8th June 1864, (laws enacted to remedy the danger which had been created by the denudation of mountain ranges), found itself face to face with a problem not only new to itself, but to neighbouring countries as well.

Observations, experience, implements and trained *personnel*,—everything had to be now found or enacted for the vast enterprise which was to be undertaken simultaneously in the Alps, the Pyrenees, the Cévennes, and the mountains of Auvergne—in other words at the headwaters of the Loire, the Rhone and the Garonne, with their formidable affluents.

Thanks to the zeal and aptitude of the forest service, and after the inevitable failures which attend every new enterprise, the elements of a solid success have at length been attained.

The Administration has always desired to interest the world in this truly national work of mountain restoration.

Numerous reports, valuable monographs and studies on the pastural system, on the method of treating torrents, have been published, and information has thus been afforded, both of the extent of the work to be accomplished and of the results obtained.

Long reports and detailed documents avail, however, little; and it was decided to instruct the crowds which thronged the Galleries of the Exhibition by some more tangible proofs, and to arrest attention by the direct illustration which models, photographs and plans can better supply.

The collection consisted of six models in relief, sixty-six photographic views, seven drawings with the camera, four maps, two pictures, and various sketches and plans. These we purpose briefly to describe.

One of the solid models represented a section of the torrent of Bourget (Valley of the Ubaye, Basses-Alpes). Another represented the same section, but in its present or actual condition, that is to say, its condition as ameliorated and modified by a series of works carried out in a space of less than thirteen years.

A third model shows in a small compass, and on a very reduced scale, the different works of defence which it is the practice to adopt, under various different conditions, for the cure of ravines and torrents.

The fourth model is due to M. DE GORSE, Sous-Inspecteur of Forests at Toulouse. It represents a torrent (Laon des Bas, Haute Garonne) which only began to exist in 1866, and which is not the less destructive for its modern origin.

This torrent is awakened into activity by the slightest storm. In comparison with this is shown another torrent, that of Saint Antoine (Isère), which M. CHARLEMAGNE, head of the reboisment service at Gap, has modelled, in the state of quiescence to which it has been reduced by a series of works skilfully carried out.

The sixth and last model, designed and executed by the same officer, is intended to illustrate the details and the results of a special process employed in the restoration of steep slopes cut up by ravines, and known by the name of "l'encrêtement des berges."

To make the subject more complete, it was thought desirable to entrust M. DE GAYFFIER with the task of collecting in each district on which reboisement works are in progress, the principal types of structure employed, and of showing, by photographic views, the application and the results of each.

This officer made a special inspection of the reboisement districts of the Alps and Pyrenees in 1877, for this purpose.

The photographs are not only extremely beautiful in execution, but their illustrative value is of a high order.

They are accompanied by explanatory memoranda, and by drawings made with the *camera lucida* by M. SARDI, Garde-General Adjoint.

There are also two maps—one agricultural and forest, the other geological—showing the upper valley of the Durance (L'Embrunais, Hautes-Alpes) that of Barcelonette or Ubaye (Basses-Alpes).

Two pictures represent the perimètre (region subjected to reboisement at the sources of torrents, &c.) of Bourget, one showing what it was in 1867, the other, how it looked ten years later in 1877.

A plan is also shown of the beds of detritus (*lits de deposition*) formed by the torrent in the regions of L'Embrunais.

Lastly, there are numerous topographical sketches, full-size designs, plans, sections and elevations of various works.

There are also models and drawings relating to the organization of "fruitières"* in the Alps and Pyrenees. It will be well to make a rapid excursion through the gallery and describe the objects briefly. To begin with torrents. The distinguishing feature of these is, that they flow in very *short* valleys or ravined beds at a very steep angle: their floods are short in duration and nearly always sudden. The peculiar mischief that

* Fruitières may be called fodder-plant nurseries or gardens.

they do is mining or digging into the mountain, and then depositing again the material so removed, and finally spreading out their debris-laden streams in all directions in consequence of their coming down on the conical or convex surface of their beds of deposit at the mouth. The plan of the torrent of Bourget, as it was in 1867, illustrates this definition. There you can see (1) the basin of origin; (2) the cone of detritus; and between the two (3) the short channel where the cutting away has ceased, but where there is not any deposit.

One can trace the torrent round its source in the windings of the mountain, see it plunge between abrupt banks rising to a great height, and forming deep gorges. When we approach nearer the sources we find a sort of open amphitheatre, a vast cauldron, yawning towards the sky, and collecting from all sides the rain and snow and the waters of storms which rush together impetuously into the gorges below.

The relief model of Laon des Bas (Haute Garonne) as it now is after undergoing the effects of many storms, represents (1) a reception basin of small extent, but great steepness; and (2) a cone of deposit formed in 1875, in a single night by a stream that had been up to that time innocuous. The torrent of Saint-Antoine (Isère), one of the numerous affluents of the Romanche, furnishes a third example. In the folds and hollows of the escarpment which overhangs the basin of reception, deep clefts give passage to the waters which pour down into the basin below, and then passing the narrow neck or channel of exit, they spread out over the deposit cone, and threaten even the town of Bourg d'Oisans.

In the basin of the Bléone (Basses Alpes) the torrent of Labouret is remarkable as exhibiting in a small space, (of 113 hectares) a complete sample of all the difficulties which can be presented in the way of the reboisement of a reception basin.

In the upper valley of Ubaye the dejection-bed of the Riou-Bourdoux torrent, traversed for 4 kilometres by the public main route from Montpelier to Coni, is shown in view No 24.

View No. 25 shows torrents with very steep, but at *the same time unstable,* banks.

The torrent of Laon des Bas is also depicted, a torrent which, since 1865, has caused such alarm in the beautiful valley of the Pique.

Views No. 52 and 53 show two ravines in the valley of Astau (Haute Garonne), which are torrents escaping from narrow gorges and falling in a series of cascades which bring down masses of detritus inundating the little valley of Gô, at their foot.

There are also views of the ravines in the valley of Bastau, which overflow with the melted snow in spring, and by streams during the summer.

Lastly, there is the torrent of Pontes (Hautes Pyrenées) whose sources lie in the heights of the Pic d'Ayré.

An examination of the photographs clearly illustrates the nature of the devastation caused by torrents.

But in order to show the combined results of torrent action on the country (as well as views of definite spots photographed), seven birds' eye or panoramic views (taken with the *camera lucida*) show the general aspect of mountain chains above the valley of the Ubaye. They show how these torrents cut up the mountain sides, fixing themselves like a leprous sore on the soil, and gradually eating away the mountain side, and creating at their base a long series of heaps of detritus which go on increasing in size and threaten to swallow up everything in their vicinity and render for ever sterile the soil which they cover up. Thus they go on covering field after field, interrupting the communications, and actually driving out the population, which is for the most part too ignorant to trace the calamity to its true cause, and in all cases wholly unable of itself to do anything to meet the danger.

The map of the Embrunais shows another remarkable instance of a torrent-ravaged country: there the public road is covered with blocks of stone, and bridges are swept away with a rough flood, while protection walls and other such devices unable to check the evil (which has its source from above) stand half buried in the ever-increasing *detritus*.

In some places there is a still more aggravated form of danger. In the *perimètre* of Saint-Pons the dejection bed of the Riou-Bourdoux is truncated by the Ubaye river. At that point,

on the other side, the torrent of Bachelard comes down, and it is easy to imagine the great danger arising from the possibility that the two beds may unite to form a vast barrier blocking the course of the Ubaye.

In the valley of Aston (Haute Garonne), there is a similar instance; there you have two torrents opposite each other, as described by Blanqui—firing at each other as it were, and threatening by their united mass of *disjecta* to force back the intervening stream.

In order, however, to complete the illustration of the causes and effects of torrent action, maps have been prepared illustrating the soil and the geologic formation, as well as the distribution of the wooded surface. Maps of the valleys of the Upper Durance and Ubaye provide this information most completely.

The maps are accompanied by a brief note relating to the movements of the population. There we can trace the denuded mountain sides, notice where a few mangled remains of scanty woodland remain, torrents which have become extinct, and their dejection beds consequently covered with cultivation. In other parts are torrents in full activity, and here and there a few pasture lands covering not one-twentieth part of the surface, while at the bottom of the valleys are seen the junction of the torrents with the main stream and the valleys situated in momentary danger of destruction. A geological map illustrates the soils in which torrents are most dangerous: schistose rocks, very friable, forming steep but regular slopes, in which forest alone can regulate the discharge of water and prevent its deeply ravining the soil: limestones more compact forming a succession of cliffs separated by more gentle slopes, surmounted by undulating plateaux which are in their turn bounded by peaks or "aiguilles" of bare rock: there are also marls, which exfoliate in the air and become subject to landslips, and dissolved by water into a blackish mud which is later hardened by the sun, and sometimes covered with a saline efflorescence.

These maps establish beyond doubt the four propositions which follow, and which are already established by other evidence:—

1. That forests protect the soil so that torrents cannot form and erode it.

2. That the removal of the forest renders the soil a prey to torrent action.

3. That even when torrents are in existence, planting and restoring the sources tends to moderate the violent action of and ultimately to extinguish the torrent.

4. That when torrents have been extinguished, the renewed destruction of the forest may re-awaken them into dangerous activity.

An attentive examination of the examples will convince any one that the violent action of torrents is due to an accumulated effect of various contributory causes, each perhaps small in itself. Inversely then, a system for effecting their extinction should consist in producing a combination of small effects, each taken in detail, no one point of action being passed over.

The gradual planting up or restoring of each branch or feeder of a torrent, acts in progressive rates by gradually diminishing the violent discharge of superficial drainage-water, and by consolidating the soil from point to point. The powers of destruction are gradually diminished, the points of resistance are gradually augmented, till an equilibrium is reached between the force of the water and the power of resistance to it, and the stream flows without the characteristic features of a torrent.

Reboisement is then the great work which offers a remedy to torrent. And truely vast is the enterprise, and immense the variety of operations which may be included as accessory to its execution. We can only notice the chief works, which are:—

(1.) Definition and demarcation of the area requiring specific treatment.

(2.) Works to render access to all parts of it for work and for inspection possible.

(3.) Creation of nurseries and seed beds to supply the material for reboisement.

(4.) Works to support and consolidate the soil, lead off the water, &c.

(5.) Encouraging a covering of grass and herbs as well as actually planting or sowing with trees.

The area or perimètre requiring attention is the whole tract subject to erosion, falling away, ravinement and channelling with water from rainfalls and storms. It is embraced by a line which not only takes in the head and banks of the main torrent, but also all the ravines and water-courses which feed it on either side.

The plans (especially) of the perimètres of Seyne, Saint Pons, Argent Double and Val de Bastan, shew the network of road and paths made to give access to beasts of burden which carry plants, seed and tools for work. In many cases, when the sides of the mountains are fissured in all directions, having such ill-balanced eroded prism-shaped masses of earth liable to fall, it only needs the encroachment of a stream below to undermine these masses and set them sliding down as in the perimètre of Vachères. The photographs Nos. 35, 37 and 38 show this. In such cases it is necessary to stop the falling away by massive supports deeply founded, and built with hydraulic lime. Built across the torrent beds, they arrest and store up the earth, mud and stones, allowing the water to pass over after depositing them.

Moreover the great hollow bed of the torrent is gradually filled up by the accumulations on the upper side of the stone weir (*barrages.*)

There is a good example in the model of the Bourget; there we have a strong stone wall with hydraulic cement. It is 32 metres, (about 100 feet) long, 7 metres (about 25 feet) high above the bed, and 2·80 (about 8 feet) thick. If the part below the bed including foundations be taken into account, it is 11·35 metres (or nearly 40 feet) high. It cost 15,500 francs. At the foot of it is a solid paving of stones to resist the effect of the fall of water over the ledge; this paving is sustained by a smaller counter-weir.

The water is made to pass by a channel protected by a

strong grating, so arranged as to cause the water to gradually deposit the materials held in suspension before it passes the edge of the weir.

There is another large *barrage* above this. The effect of this is gradually to fill up the deep bed of the torrent, and then it becomes of importance to diminish the flow of the water, and plant up all the banks, &c., so that, not only should the water-flow be moderated but no further erosion should take place. [Remembering always that the violent scouring action of torrent is due not to the action of water *as water*, but to water charged with a mass of stones, earth, &c., which it obtains by the falling in of the sides, &c.]

In order to protect the banks above from falling in, they are planted, but all the upper bed of the torrent is crossed at every 16 feet or so, by a series of parallel hurdles (*clayonnages*) like the rungs of a ladder.

The model of the torrent as it is now under these works is rendered doubly interesting by a model which shows what the torrent was before they were commenced.

Numerous designs show the various forms of work.

Barrages (weirs) with curved facing.

Ditto with straight facing.

Rustic weirs, (made of undressed wood work).

Spurs of piles, (*radiers*).

Buttresses (*contre barrages*).

Spurs made of pyramidal arrangements of stout posts and bars, (*épis*).

Ordinary spurs (*epérons*).

Dams of earth.

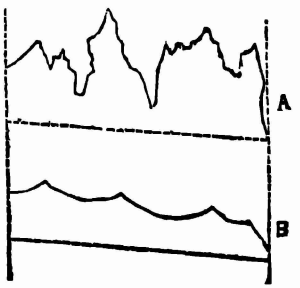
Dry stone walls (*perré*).

The *barrages* are often raised as they get levelled up in the up stream direction by the deposit of material. Water exits are thus left in the courses of masonry to allow of the discharge of the water of infiltration. View No. 35 shows some powerful stake and hurdle works put up in the lower part of the Combe St. Bernard (Basses Alpes). They consist of vertical stakes fastened together by tie rods (*longrines*) and wattled together

with willow branches, and again supported by a tie, propped with four stakes. If all these stakes take root, the weir becomes a "living weir" tending always to grow stronger.

The method of using fascines is illustrated by Views 35 and 38, 39 and 41, and No. 19 shows how they are made. It shows in fact a lot of workmen employed in the process of "slope cresting" (*encrétement des berges*) in the perimètre of Curusquet. The debris are always thrown down into the depths of the ravines and help to fill it up.

This "slope cresting" has been practised on a large scale in the Hautes Alpes. There is a model showing its effect, *i.e.*, the slope cut up by steep ravines is shown, and then the same slope is exhibited as modified, the former steep angles are all reduced and rounded off like sloping roofs, and the ravines filled up so that the surface can be planted.

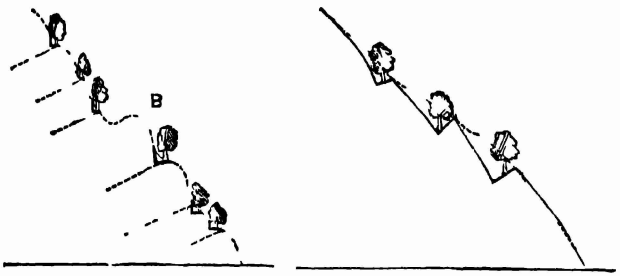


The methods of planting adopted are very various, requiring a selection of the species which will best suit the soil, elevation, &c. Knowledge and experience are also requisite to determine whether to plant or to sow, whether to plant all over or in strips, or in interrupted belts, in holes at regular distances, &c.

View No. 1 (perimètre of Entraines) shows a steep slope (80 in 100) cut up by a series of deep ravines, prepared for planting by a series of ledges (*banquettes*) slightly sloping inwards towards the hill side: the outer edge is planted with trees close together, furnished from the nurseries.

NOTE—It is not easy to describe the process in writing, nor to find any but a coined term to indicate it. The object appears to be by, the aid of digging down the soil and then protecting the surface by rows of fascines or enormous faggots staked down; the result is to reduce a surface whose section originally would show (*a*) to one which shows (*b*).—(B.P.)

There is another method of making a numerous series of *cordons*, —rudimentary ledges sloping inwards and planted: the plants *being covered by the earth* thrown down from the ledge immediately above. The inner bank is cut perpendicularly by this method (*b*), the profile of the slope is not altered as it is in the other (*a*).



Wherever it is possible the sloping spaces between the ledges are sown with seeds of forage plants and grasses; and with these, seeds of hardy conifers are sometimes intermingled. If the soil is stable, these plants help to prevent drying up, and to retain a certain freshness as well as to supply fodder, or if allowed to decay, to furnish vegetable mould; if the land is unstable and liable to slip away, their roots tend to consolidate it.

The views numbered 20 and 21 shewed the combined effects of such works: they are views of Labouret. In less than 13 years the aspect of this "perimètre" has completely changed.

Formerly there were great bare slopes of blackish marl always slipping away; now they are all covered with trees and with a dense growth of herbage suitable for fodder. Numerous small ravines, once forming so many channels to swell the floods in the main torrent, are now filled up, their beds have disappeared under the effect of the fascines employed to fill them up, and of the leaf-bearing trees planted above them. The whole basin of the torrent is now completely re-stocked, and the once redoubtable torrent is now a permanent and harmless stream.

The views numbered 22 and 23 (*Seyne*) show how the character of the torrent bed gradually changes under the effects of treatment. The sharp angular figure which would be at

first shown by a transverse section becomes rounded off or reduced to a curve; steep banks take a lower angle, and the upper crest (arête) of the banks becomes blunted or rounded off: herbaceous vegetation begins to grow on the slopes, and thus they become stable and consolidated. Then the torrent gradually ceases its violent *erosive* action: then as vegetation progresses these regions, which once showed only ruin and barrenness, now begin to indicate a young forest of pine or larch.

The whole of the works combine to afford a thousand small obstacles to the water as it flows to join the torrent channel; and what is of more importance still, combine to deprive it of its cumulative *velocity*, and of its power to *carry down sandstones &c.*, so that when at last it reaches the torrent stream, it is only *limpid water* that gets into the channel, and that with a moderate flow. The attention of the Forest Administration has also been turned to the subject of preventive and protective works in the case of wooded slopes in the mountains which are still comparatively intact and uninjured, but the horrible destruction of which would be productive of great mischief. Pastoral Associations have been formed with a view to regulate the grazing of cattle, and so to prevent overgrazing in any one locality, and to ameliorate the pasture lands (as such) and so increase their productiveness. There are views showing the arrangement of "fruitières" in connection with this work.*

The great object to be aimed at is to recognize the true distribution of function (or may I call it a division of labour) which must be preserved in mountain regions, and which it is the object of reboisement works gradually to restore.

The mountainous districts usually exhibit a series of valleys, and perhaps a stream at the bottom, and a greater or less width of level or nearly level land, or a succession of two or more

* There is no detail given about "fruitières," but I understand these are enclosed gardens or fields distinct to the production of green stuff for fodder of the best and most suitable kinds, and possibly for roots adapted to cattle feeding, such gardens also supplying seeds and stock for further propagation of the plants The supply of fodder in this way of course relieves the over demand on the natural herbage, and allows the support of a larger number of cattle while the grazing grounds are being allowed rest. The whole subject of grazing grounds is becoming of pressing importance in Northern India, and is one to which the Chief Revenue authorities and the Government are much to blame for persistently refusing to pay any attention It is sufficient to record an ample grazing right without a thought of whether the land is in a condition to bear grazing or not.—B P.

terraces. These are of course cultivated above them, also in many cases there are the lower slopes, also growth as a rule on the hills which rise on either side of the valley. These may also be terraced and cultivated: above that comes the region of somewhat steeper slopes, more or less interspersed with rocky steeps. This is the region of forest. Beyond this again you come to vast grassy slopes, often gentle and exhibiting large undulating plateaux. This is the proper home of grazing interests. If the general division of labour be kept to, each interest is secured, cattle are in their proper places, and cultivation in its.

It has often been asked whether any human efforts at reboisement can really cope with such a gigantic evil as that which a developed torrent-region exhibits. It must at once be admitted that the work is vast and must be slow and gradual, but it is certain in its effect, and ground once gained is never lost. The results attained in France, and illustrated by the collection, a brief and imperfect description of which has now been presented, prove incontestibly that good *can* be done. Though of course its worthiness, the deep struggle it involves, warns us that prevention is better than cure, and that we *must* take steps to secure the forest against denudation rather than wait for the time when, with much labour and privation, we have painfully to set to work to restore.

At the same time it is no professional prejudice or departmental hobby that reboisement work can be successfully undertaken. The opinion of a noted French Engineer (not a Forest Officer) in 1870 may be quoted as good evidence on this point:—"The idea of reboising mountains has now become a reality in the hands of the Forest Administration. A staff of officers, earnestly devoted to the task, has for several years past carried out, not only in the Hautes-Alpes, but in all the mountainous districts of France, a combined system of works of reboisement;—they have accomplished a task as difficult as it is worthy of praise. If circumstances have created difficulties in the practical application of the plans of work, those difficulties have been overcome by wisdom and perseverance: at length a measure of success has been obtained which has never fallen short of our expectations, if it has not in some instances surpassed them. The

work is carried on in retired spots and distant valleys, hidden in the mountain recesses of France, but one day, when public attention is attracted to them, their true extent and value will burst forth in a manner that will astonish us, and will secure for those great works a foremost place in the catalogue of the great and glorious works which characterize the age in which we live."

* * * * * * *

(*Adapted from the French of M. Thelu, by B. H. Baden-Powell.*)

Utilization of Salei Wood for Sleepers.

(*From Indore Forest Report in the "Indian Agriculturist" of May* 1878, *p.* 170.)

Mr. Carey, the Chief Engineer of the State, reports:—

"*Forests.*—Since last year the jungles of the Bai districts have been added to my care; much fuel, teak bullies and logs for shoring up foundations of bridges have been supplied to the railways.

"Large quantities of bullies are being supplied to the Military Department, Indore, and to numerous village people for building their houses and for farming purposes.

"*Sleepers.*—Experiments have been and are being tried on railway sleepers; in February last year, six Salei sleepers were cut green and immersed in a tank (made expressly for the purpose) filled with Behera leaves and water; in the June following these sleepers were put down on the Neemuch State Railway, and are to this day as sound as the day they were put down. This wood was always considered next to useless, as being so readily attacked by insects, but five months' soaking in a solution of Behera leaves, whose tanning properties are well-known, has proved that sleepers can be obtained from this tree. We have vast quantities of Salei in our jungles, well grown, capable of making on an average quite 8 half-round sleepers from each tree; of course, time will test the life of these five sleepers; at present they look most healthy and promising, and if they turn out long-lived, we are safe to find a market on the

two lines of Holkar and Neemuch State Railways, and thereby make a good revenue.

"One hundred Salei sleepers were cut in June 1876, and laid in the Kanar river and left during this monsoon with the intention that all impurities should be soaked out in the running water; after the rains only, 49 sleepers were found; the rest had been washed away; these have been laid down on the Holkar State Railway by the kind permission of the Engineers; on trial they appear sound, but the action of weather and being constantly run over by trains will soon test their worth. We could supply Unjan sleepers, but they are worth more to us at the Indore market as logs than being cut up into sleepers; the rate for sleepers being rather at a low price."

JJ. Reviews.

Review of Forest Administration during 1876-77.

By Dr. Brandis,
Inspector-General of Forests.

It is a great pity that circumstances prevent these reviews from issuing earlier; at such a time as this we should be expecting a review of 1877-78 rather than of 1876-77. Nevertheless, it will be useful to make a few remarks on the chief points of interest in the Inspector-General's summary. The chief point—a point which seems to give a character to the whole of Dr. Brandis' Review—is that of the "increase and development of demand, and the desirability of utilizing minor sources of revenue." In speaking of the forests in Bengal he says: "The chief timber trees in the reserved forests of the Lower Provinces of Bengal are sál, sissú and sundri; but they also, as well as all forests in India, contain many kinds, which, when better known, may be important articles of trade. Already a number of woods, formerly unknown, are now used largely for the manufacture of tea boxes, and it obviously is of the utmost importance for the success of Forest Administration that the number of woods used and sold otherwise than as fuel should be extended." That the extension of tea planting has given an immense impetus to the demand for the lesser known kinds of timber, as well as for large quantities of firewood, bamboos and grass from the forests of Northern Bengal, is very apparent, and it is very instructive to notice how the demand for this produce has yearly increased, partly by the extension of the area under tea; partly by this extension causing a corresponding demand for the fuel necessary for tea making, for the timber of which boxes are made, and for the materials for the construction of houses, factories and huts; and last of all, partly by the indiscriminate and careless felling of timber on private lands. It may even be predicted that, before long, the forest area will be inadequate to fully

supply the demand, and it is evident that the greatest care will have to be taken to husband the resources of the forests, and effectually to provide for reproduction. The forests of the Central Provinces, like those of most other parts of India, labour under the disadvantage of being far away from the market to which their produce is taken, and on this the Inspector-General remarks: "The general policy of the Forest Department throughout the country must be to encourage the consumption of forest produce; and consequently while, on the one hand, it is proper to extend the existing reserved forests and to form additional reserves in the immediate vicinity of large centres of consumption and of the open, densely inhabited country, on the other hand, the extension of cultivation to the very edge of the reserves should be encouraged wherever there is reason to believe that a sufficient area of forest has been demarcated and reserved." Dr. Brandis takes a hopeful view of the extension of demand in the Central Provinces and the neighbouring province of Berar, when he says regarding the Central Provinces that: "if Forest Administration in these districts is permitted to progress as it has commenced, the distribution of forests will be similar to what exists in France and Germany; they will be surrounded by rich fields and flourishing towns and villages, and their produce will serve to facilitate and will stimulate the progress of agriculture and industry in the country," and speaking of the District Forests in Berar that: "the maintenance, and if possible the improvement, of the forest growth on these dry and hot hills will eventually be found to be a most beneficial measure for the agricultural population, inasmuch as these tracts will furnish wood, bamboos, an abundance of grass, and in many cases pasture."

That the so-called 'Minor Forest Produce' is gradually beginning to play a larger and larger part in the economy of Indian Forests is evident from the table in paragraph 59, which we reproduce, giving the amount of minor produce exported in 1876-77, compared with the average of the six previous years:—

	Quantity in Tons of 20 cwt., in the case of teak, 50 cubic feet.		Valuation at port of shipment in 1876-77.	
	Average of 6 years, 1870-71—1875-76.	In 1876-77.	Total.	Per ton.
		665	Rs.	Rs.
1. Caoutchouc ...	785	4,494	9,01,693	1,356
2. Shell-lac ...	3,025	953	42,20,497	939
3. Lac-dye ..	578		3,78,556	397
4. Sandalwood, ebony, and other ornamental woods ...	.....	 13,247	2,65,071	.....
5. Cutch	9,640	17,925	25,05,515	189
6. Myrobalans ..	.....		13,50,254	75

It will be seen that there is an increase in the amount of Lac exported as well as in Cutch and Myrobalans, the trade in these latter having lately been largely developed in consequence of arrangements in the Southern Division of the Bombay Presidency. The amount of Caoutchouc has fallen off; partly, we suppose, from overtapping in Assam, partly from the discontinuance of collections in Sikkim.

In the matter of fire protection, the chief progress was made in the Central Provinces and Berar, in the latter province some reserves having been protected for ten and one (Bori) for 13 years. The Inspector-General, in pointing out that nearly one-third of the entire area of Reserved Forest in the Central Provinces is now under strict protection, says: "Considering that formerly fires were an annual phenomenon in these forests, an idea can be formed of the vast importance of these operations. Fire protection continued for ten years and combined with otherwise suitable management, converts a badly stocked and unproductive jungle into a dense luxuriant forest."

In the North-Western Provinces the area under fire protection has been increased. Protection in Oudh has not progressed owing to the whole of the forests being annually grazed over and consequently burnt.

The greater part of the Ajmere forests were saved from being burnt over, and some progress was made in Burma; while even in Bengal, probably owing to the favourable year, some success was attained. In that province a new plan of protection is being carried out, described by Dr. Brandis as follows: "Fire protection in Bengal is a more difficult task than in most forests of North and Central India, chiefly on account of the extremely luxuriant and rapid growth of tall grass in the extensive savannahs and tracts of incompletely stocked forests. Under these circumstances every effort must be made, by planting and by protection from fire cutting, to increase the cover over-head, at least in a broad outer belt around the reserve, and thus gradually to suppress the luxuriant growth of grass in this outer belt. The Conservator correctly remarks that it is impossible to say whether his efforts will prove successful in an unfavourable year until he has established thick belts of trees along the boundaries of all forests to be protected. As a beginning he has planted a belt of sál 100 feet broad on the southern boundary of the Buxa reserve."

The question of the destruction of the forests on the line of the Western Ghâts is discussed by Dr. Brandis under this head, in treating of the protection from fire of the forests in Coorg. We cannot do better than reproduce his remarks:—

"In *Coorg*, the Conservator reports that a commencement in cutting fire lines round the forests has been made. In this small province, the forests have a special significance, and it is most desirable that they should be strictly protected and steadily improved. Coorg is bounded on the east and north by Mysore, on the south by Wynaad, and on the west by Malabar and South Kanara. In Mysore, reserved forests have been demarcated, and are at present under strict protection and careful management, but it is impossible to foresee whether forest conservancy will be maintained after the province shall have ceased to be under British rule. In Wynaad certain limited forest tracts are the property of the State, but the boundaries are not clearly defined; there have been encroachments, and it is doubtful what proportion of this area will be permanently maintained as Government forest. In Malabar, all forests are private pro-

perty, and in South Kanara also, where formerly Government was supposed to possess extensive forest lands, nearly the whole of the forest seems now to be regarded as private property, and kumri cultivation, which had long been prohibited, is again generally practised. Coorg is thus on all sides surrounded by provinces, in which the maintenance of forest conservancy is doubtful. Under these circumstances, the denudation of the provinces by which Coorg is surrounded will, if peace and good Government continue, only be a matter of time. What the effects of such extensive denudation upon the general prosperity of the country will be, it is impossible to foretell, but the maintenance of a large forest area in Coorg seems under these circumstances to be highly desirable. Moreover, Coorg is a mountainous country, and is situated near the line of ghâts. We cannot yet attempt to define the influence which the forest growth on and near the line of the Western Ghâts exercises upon the climate of the Peninsula, but we know that it has an undoubtedly great influence in regulating the water-supply in the rivers; and wherever Government has the power to do so, every effort should be made to guard against the denudation of the line of ghâts. In the Khandesh, Násik, Ahmednagar, and Poona districts, very little forest is left on and near the line of ghâts; in Sattara and Belgaum large tracts had been set apart to be permanently maintained as forest, but since 1874 kumri cultivation has again been permitted, and denudation of large areas will be the inevitable consequence of this measure. In North Kanara, vigorous efforts have been made to secure the maintenance of large forest reserves, and if these efforts are successful, the benefit to the country will be great. As already explained, the maintenance of the forests on the ghâts of Mysore and Wynaad is doubtful. On the Nilgiris, denudation is believed to have made more progress than is desirable. South of Coimbatore there are the ghât forests of Cochin and Travancore, over which Government has no control, and contiguous to them are the forests of Madura and Tinnevelly, the greater portion of which is now held to be private property.

Coorg is a small province only, measuring 2,000 square miles; the demarcated reserves measure 380 square miles, and the most perfect forest conservancy on this limited area cannot be

expected to have more than a local influence, but it clearly is the duty of Government, when such can be done, to set an example of effective forest administration on the line of ghâts, and after having effected demarcation, the protection from fire of these reserves is the next step. If the forest staff in Coorg is too weak to maintain an effective fire conservancy, it must be strengthened, for the maintenance and improvement of these forests has a special significance."

The financial results of the year 1876-77 show a falling off in surplus revenue compared to 1875-76, when the surplus was very high; the results of the year were :—

	Receipts.	*Charges.*	*Surplus or Deficit.*
Government of India.			
Bengal ...	2,22,401	2,19,689	+ 10,712
N.-W. Provinces ...	7,61,658	6,27,640	+ 1,34,018
Punjab ...	5,98,754	5,22,483	+ 76,271
Oudh	3,89,013	2,32,609	+ 1,56,404
Central Provinces...	6,61,326	2,88,640	+ 3,72,686
B. Burma ...	15,51,468	10,05,044	+ 5,46,424
Coorg ...	75,929	33,329	+ 42,600
Ajmere ...	905	22,458	— 21,553
Assam ...	81,568	89,920	— 8,352
Surveys ...	.....	57,504	— 57,504
Presy. of Madras	4,15,312	4,13,970	+ 1,342
„ *Bombay*	12,26,658	8,31,942	+ 3,94,716
Native States			
Mysore ...	4,66,956	2,26,862	+ 2,40,094
Berar ...	2,53,136	94,562	+ 1,58,484
	67,05,084	46,58,742	20,46,342

The Journal of Forestry and Estates Management.

At time of going to the press the December number has not been received; we can only continue our observations which, in our own October number, extended to the three numbers for July, August, and September, to the remaining numbers for October and November.

The number for October, as usual, contains some remarks, the interested object of which is to secure forest appointments in India to persons in a socially inferior rank to that which it is essential (constituted as our imperfect society is) to the conditions of Indian life to secure; and to train them in England, where no means exist of giving them any idea, even of the manage-

ment, of *natural* forests on a large scale. We only thank the Editor for sparing us the trouble of seriously refuting his remarks and conclusions, by his adoption of a tone of silly invective, coupled with a complete and often inexcusable ignorance of facts, which is its own condemnation, and which will effectually prevent any candid person acquainted with the circumstances from recommending an alteration in a system which, taking it as a whole, has, as far as it has gone, yielded results, the excellence of which has surpassed the moderate expectations of those who first cautiously introduced it.

Dr. J. C. Brown contributes a paper on the Annual Meeting of Foresters, Forest Proprietors, and Forest Professors and Officials at Dresden in August 1878.

The following passage we extract, but we regret to note that no account whatever is given of the opinions evoked on either question :—

"The meeting at Dresden was attended by upwards of 250 members (I think 262), amongst whom were 158 Saxons, 35 Prussians, 31 Bavarians, 4 Austrians, 2 from Russia, 1 from the United States of America, and 1 from Britain.

I was impressed with the manly bearing and intelligent look of the members of the assembly. They were educated men, holding rank equally with officers in the army and the navy, and the civil and diplomatic service of the country, many of them holding titles of dignity, and being called chiefly to the discharge of duties in the open air, they had nothing of the emaciated frame and sickly look often seen in ecclesiastical courts and other gatherings of professional gentlemen engaged in chamber study.

The meeting was opened on the first day by the Saxon Minister of Finance, Herr von Könneritz, and the principal sederunt of the second day was attended throughout by His Majesty the King of Saxony, and members of his suite.

The large and elegant hall of the Gewerbe Haus, in which the meetings were held, is surrounded on three sides by a gallery, which was appropriated to ladies and visitors. All the members wore on the breast of their coat a green-coloured badge, and on the button on the other breast a number, which, corresponding with the number of their name on the printed list of members

attending, greatly facilitated personal intercourse betwixt those desirous of conversation on subjects discussed, or others in which they were interested, and rendered unnecessary formal introductions by some common friend.

For such conversation abundant opportunity was afforded by recesses in the course of the day, by re-unions in the Belirden Music Hall in the evening, and at social meals, and by excursions.

The first subject submitted for discussion was the question: "On what principle should the agreement or compensation for the surrender of forest servitudes or forest rights, possessed by commoners or by individuals, be based?

Many Crown forests and others are subject to rights acquired by purchase, by grant, by protracted usage and inheritance, rights of pasturage for sheep and other cattle, rights of mastage for swine, rights of building timber, or of firewood or leaves for stable use. These interfere greatly with the proposed exploitation and management of the forests. It has been sought to extinguish these wherever this could be done with the consent of those interested, on terms equitable and satisfactory, meeting the claims of the future generations as well as those of the present. Hence the question."

The second subject was: "To what extent should the influence of the State be canvassed on forest operations and private property?

The principle has been extensively accepted that forests, like mountains and rivers, are national property—in other words the property of the nation, understanding by that term the nation in its entirety, including all its generations, generations unborn as well as generations past and present, of which each successive generation has only the usufruct, and this under an obligation to provide an equivalent for whatever in excess of this may be destroyed. It is alleged that no proprietor has a right to destroy a forest on the brow of a hill which has acted as a wind-brake to the valley or plain beneath; that no proprietor has a right to destroy trees growing on drift sand, which, once laid bare, might devastate the country beyond. And, in view of this, many questions arise requiring the determination of the right brought under discussion by the question thus stated.

The third subject discussed was the railway tariff for the transport of wood. "Through railway combinations and local interests, it happens that forest products of Germany are conveyed to other countries at a lower charge than to places within the empire through which they pass. And though the market price may be obtained by the forest proprietors, the home market is deprived of needed supplies, and the prices raised to the home consumer. Forest science includes political economy as well as meteorology, geology, and botany; and thus the subject in question found its place amongst those discussed at the meeting of foresters."

The fourth subject was the standing one of communications in regard to noteworthy incidents, experiments, and observations connected with forests and forestry, and the communications were as numerous and as varied as those at previous meetings."

A BRIEF note on the "Trees of Ancient Palestine" should be read.

FOLLOWING this is a note on "American forests." The opening description is very pleasingly written. There is also a good account of the Sugar Maple and other American trees.

AMONG the notes, an account is given of two Eucalyptus trees, one which had broken off at 450 feet, and one of *E. amygdalina*, in Dandenong District, Victoria, of 380 feet from the root to the first branch, and 450 feet to the top twig. This tree would overtop the tallest known *Wellingtonia Sequoia* as well as the Clock Tower at Westminster, by 120 feet.

THE NOVEMBER number compliments the Government of India on the establishment of a forest school at Dehra Doon, and notices the deputation of Mr. George Takeda from the Agricultural Department of Japan, to enquire about the forests of India.

MR. BURROWS has a paper on the growth of Coppice and Underwood. It seems that the word "store" is good English for the standard trees left, in the "Taillis-sous-futaie" of French Forestry, and this system which we have awkwardly attempted to describe in English by the term "Coppice under Standards" might now neatly and appropriately be described as "Stored Coppice."

MR. BARRY has commenced a paper on "French Forestry at

the Paris Exhibition." The introductory account of the climate and mountain ranges of France will be read by many with interest as giving in a brief space a *conspectus* of the conditions of forest growth in France.

Dr. Brown continues his "Glances at Forestry in Northern Europe," devoting his attention to Sweden.

We beg to extract the following brief note on "Wood Ashes" as Manure:—

Value of Wood Ashes as Manure.

"The experiments carried on with leached wood ashes in America continue to be favourably reported on, and to win more friends every year. They have been used for many years by the farmers and market gardeners of Long Island, and later by the same classes in the sea-coast towns of Connecticut, and also on the tobacco farms farther inland. Leached ashes contain considerable quantities of potash and phosphoric acid, which have a wonderfully invigorating influence upon exhausted soils. The onion-growers make large use of ashes, buying them sometimes by the thousand bushels. Fruit-growers are much pleased with its effect upon the growth of trees and shrubs, and upon their productiveness. Their effect is said to be immediately visible in old pastures and meadows, sown broadcast as a top dressing; but they act still more satisfactorily if applied to the crops at the time of seeding down. They not only largely increase the crop with which the grass seed is sown, but their influence is visible for many years afterwards in the increased yield of grass. A farmer who has used ashes freely for twenty years upon a hard, worn-out gravel soil says they will give an increase of hay upon a meadow newly stocked for eight years; and then, if the field be ploughed again, they will show the effect of the ashes for six years longer. He applies about 100 bushels to the acre, on land that he designs to keep in permanent meadow, and about 75 bushels to pasture land. It is particularly satisfactory as an application to a rye crop, even in so small quantities as 20 bushels to the acre. He has reclaimed a large breadth of old fields given up to the growth of bushes, briers, and brakes, and made it a fine pasture by taking rye crop manured with ashes. He considers leached ashes his most efficient helper in transforming an ex-

hausted, worn-out farm into one of great productiveness, giving a fair reward for his capital and labour. In commenting on the value of wood ashes, Professor S. W. Johnson, of New Haven, Connecticut, says, in the *Country Gentleman*, that wood ashes are a good fertilizer is well proved; that they often do well on all kinds of crops, and a great variety of soils, is a perfectly authenticated fact; that they often show no perceptible influence on this or that crop, on this and that soil, is another fact no less thoroughly established; that in a multitude of cases wood ashes would give good crops, but some other fertilizer would give better ones, at less cost, may fairly be inferred from the recorded experience of careful experimenters. In the face of these uncertainties local experience of the nature of the soil, crops, &c., is the best guide in their application; and if there is none to appeal to, a trial on a limited scale should be made to test its powers."

We also make the following extract as a forest curiosity:—

"Sir Edward Kerrison, Bart., of Oakley Park, has just made a valuable present to St. Edmund's Catholic Church, Bury St. Edmund's, through Mrs. Milner Gibson, consisting of a neat gothic alms-box, of oak, taken from the tree to which Saint Edmund, the "Martyr Mayde and Kyng," as Lydgate calls him, was tied at his martyrdom by the Danes, A.D. 870. The oak, to which tradition has always given the name of Saint Edmund's Oak, stood in a field close to the park of Sir Edward Kerrison, at Hoxne, near Eye, Suffolk, and on the 11th of September 1848, when it fell, appeared to be in full vigour. The branches of this noble tree spread over a width of 28 yards, which, added to the exuberance of its foliage, was probably too much for it to support. The trunk, shivered in the middle, was 20 feet in circumference. The annual rings or layers of the tree were considered by competent judges to show a growth of more than a thousand years. It is a curious fact that there was found deeply embedded in the trunk, about a man's height from the ground, an iron arrow-head, which may have been part of the actual arrows directed by the Danes against the royal victim. We are informed that the piece containing the arrow-head is carefully preserved by Sir E. Kerrison, and that he has erected a runic cross on the spot where the tree stood."

JJJ. Notes and Queries.

"Nature," of November 7th, says that Mr. A. R. Wallace, the traveller and naturalist, is a candidate for the post of 'Verderer' of Epping Forest. We should like to know something about the duties of the Epping Verderer, as we have always been led to think they consisted only in preserving a pleasant picnic ground for London excursionists. Mr. Wallace is said, however, to have himself written a description in the *Fortnightly Magazine*.

In the "Journal of Botany" for November 1878, a new oak from Assam is described by Dr. Hance under the name of *Quercus Kurzii*. Dr. Hance says :—

At the close of the summer of 1877, just before leaving Calcutta for Penang, where he was prematurely cut off in the prime of life, that indefatigable and conscientious botanist, the late Mr. Sulpiz Kurz, sent me a few Indian oaks for examination. The only novelty in the very small collection was a curious species, ticketed in pencil, in Mr. Kurz's autograph, "*Castanea semicristata*, Kurz."

Apart from the question of the claims of *Castanea* and *Castanopsis* to generic rank, the consolidated styles of the tree under consideration show that it does not fall under either group. As it has, moreover, unless I err, never been published, I desire to dedicate it to the memory of its discoverer, whose untimely death is a sad loss to Indian Botany, Mr. Kurz's knowledge having been very sound, and his experience as a working naturalist unusually wide.

"The species stands next to *Q. Blumeana*, Korth., and *Q. encleistocarpa*, Korth., of which the second alone is known to me from specimens, but it is very distinct from either. The fruit is more like that of *Q. lanceæfolia*, Roxb., and *Q. fissa*, Champ. (with which latter it agrees in its cotyledons), except for the

close grey down of the involucre, which is like that of the callæocarpoid *Castanopses*; but both those species belong to *Pasania, Chlamydobalanus.*"

We hear that a very complete library, Museum of Forest Products and Forest Herbarium, is to be formed at the Forest School of Dehra Dún. As soon as the collections are arranged, and officers have sent what they know to be authentically correct, we trust the School authorities will be in a position to determine specimens of all kinds that may be sent to them—plants, woods, seeds, gums, fibres and all.

How is it that no one in Burma has yet found out what the well-known trees *Hmanthin, Karaway* and *Sinkozi* are? They are believed to be laurels, and have much the same scent as the Nepal camphor wood, only fainter; but cannot some one send up the flowers, fruit and leaves, say, to Dr. King? They are not even mentioned in Kurz's flora, though the names occur in almost every Burma Forest Report.

We notice also in Dr. Brandis' Review of Forest Administration in India for 1876-77, mention of a Chittagong tree, *kandeb*, with no name known to science; somebody should find it out. From the wood it would seem to be a species of *Calophyllum C. polyanthum.*

It is said that the Madras Government have at last stopped the disposal, by sale or lease, of the shola lands on the Nilgiris, until demarcation of Government Forest Reserves has been completed. We are glad to hear of this step, though it is probably almost too late.

We hear that considerable reductions are contemplated in the Forest staff of Mysore, consequent, we suppose, on the approaching majority of the Maharaja. It is said that the Mysore Forests are very fine now; what they will be like in ten years it is difficult to conjecture.

THE Cyprus Forests have been lately much discussed. It appears that a Deputy Conservator of Forests, now on leave, is to visit them and make suggestions for their improvement.

IT is whispered that the "seeds received from Dr. Forbes Watson," sent out some time ago and distributed, are only *Acacia Farnesiana.*

Eucalyptus citriodora is growing beautifully at the Saharanpur Gardens; the leaf is one of the prettiest we ever saw, and the scent exactly that of the lemon-scented Verbena or *Aloysia.*

THE *Pithecolobium Saman* is, indeed, a wonderful tree; we have just seen an avenue of fine specimens in the Calcutta Botanic Gardens, only a little more than four years old. But what a pity it branches so soon!

WE have received a letter, signed M. C. H., asking for information on the uses of sunflower seed. As however, M. C. H. has not, as customary, informed us of his name and address, we can only regret our inability to print his letter.

WE have received from Baron Von Müller plates of *Eucalyptus viminalis* and *E. pachyphylla.* We presume they are the first of a series which cannot fail to be most useful. They are nicely done, with careful dissections, and look as if they well represented the character of the species.

CUT timber from the middle of September to the middle of December, and you cannot get a worm into it. October and November are perhaps the best months, but if cut from March to June, the timber cannot be saved from worms. A trial was once made with four pieces of oak cut down in December, January, February, and March. A tin ring was fixed on the end of each, and these rings were filled with water. The January wood, after forty-eight hours, allowed a few drops to pass; during the same time the entire quantity ran through the Feb-

ruary wood, while the water passed through the March wood in two hours and a half.—(*Timber Trades' Journal*, August 3, 1878.)

COLOURING WOODS.—A German published, some time ago, the following directions for colouring woods; the surface to be smeared with a strong solution of permanganate of potash, which is left on a longer or shorter time according to the shade required. The woody fibre decomposes the permanganate, precipitating protoxide of manganese, which is fixed in the fibre by the potash set free. In most cases, five minutes suffices for the operation. Cherry and pear-tree wood are most easily attacked, but a few experiments will serve to show the most favourable circumstances. When the action is excited the wood is carefully washed, dried, and afterwards polished in the ordinary way. The effect of this treatment on many woods is said to be surprising, particularly on cherry wood, to which a very beautiful reddish tone is communicated. The colour is in all cases permanent in light and air.—*Ibid.*

ANCIENT WOODEN WHEELS.—Some old wooden wheels were discovered some years ago in the mines of Portugal, supposed to have once been used by the Romans for hydraulic purposes. The wheels—eight in number—are made of wood, the spokes and felloes of pine, and the axle and its support of oak. They are supposed to be at least 1,450 years old, yet the wood is in a perfect state of preservation, owing to their immersion in water charged with the salts of copper and iron. A similar instance occurred in St. Domingo, an old wooden wheel being found in a disused copper mine. How long it had lain there is uncertain, but it was completely preserved, owing to its having absorbed considerable quantities of iron and copper. The preserving power of such impregnation is best illustrated in the wood used in the mines of Hallien in Austria; the timber used being the same which was originally introduced anterior to the Christian era, and is even now in a very perfect condition.—*Ibid.*

THE EFFECT OF COAL TAR *vs.* QUICKLIME ON UNDERGROUND TIMBER.—At the Framwellgate Colliery, some time since an experiment was made to ascertain the comparative preserving

power of coal tar and quicklime upon underground timber as compared with each other, and with unprepared timber. On September 29th, 1849, three larch tramway sleepers, each three feet long, two and a quarter inches thick, and five inches wide, were selected and placed in the air course of the Hutton seam. No. 1 sleeper was prepared by receiving two coats of quicklime. No. 2 was prepared by receiving two coats of coal tar. No. 3 was in its unprepared or natural state. The three sleepers were supported at their ends by small pillars of bricks, and weighted in the middle with fifty-six pounds of metal. On January 6th, 1852, the unprepared sleeper was found broken and quite decayed. On November 1st, 1854, the sleeper prepared with tar was found broken and decayed. On December 23rd, 1856, the sleeper coated with lime was found in the like condition. From the above it appears that No. 3, or the unprepared sleeper, broke after two and a quarter years' exposure. No. 2, or the tarred sleeper, broke after five and a half years. No. 1, or the limed sleeper, broke after seven and three-quarter years. And that the sleeper prepared with tar had a duration of 2·84 years beyond the unprepared one, while the whitewashed sleeper survived the same for five years, and the tarred one for 2·16 years.—*Timber Trades' Journal, November 9th,* 1878.

JY. The Timber Market.

Proceeds of an Auction Sale held in London on July 10th, 1878, by Messrs. Churchill and Sim, of a consignment of Indian woods per S. S. "Dorunda."

No. of Lot.	No. of Office List.	No. of pieces.	Name.	Weight in cwt.	Amount received. £.	s.	d.	Rate per ton. £.	s.
139	H 424	7	Buxus sempervirens (boxwood)...	2	0	14	0	7	0
140	H 425	7	Olea cuspidata (olive) ...	3·75	1	3	4	6	0
141	H 429	4	Symplocos cratægoides ...	0·75	0	5	7	1	0
142	B 564	4	Ægle Marmelos (Bael) ...	4·75				1	0
143	D 1278	1	Nephelium Longana ...	2·6	0	2	7	1	0
144	D 1282	1	Anogeissus latifolia	3·8	0	3	10	1	0
145	D 1280	1	Terminalia Chebula	4·55	0	5	8	1	5
146	D 1279	1	Calophyllum elatum (Poon) ...	2·1	0	2	8	1	5
147	E 1400	1	„ polyanthum ...	5·45	0	5	5	1	0
148	E 1272	1	Lagerströmia Reginæ (Jarúl) ...	3·1	0	4	8	1	10
149	W 1220	1	„ lanceolata ...	9·2	0	18	5	2	0
150	H 780	1	Juglans regia	1·25	0	5	2	4	0
151	H 616	1	Cedrus Deodara	4·1	0	10	3	2	10
152	E 1277	1	Podocarpus bracteata ...	2·95	0	3	8	1	5
153	B 569	1	„ latifolia... ...	3·25	0	4	1	1	5
154	E 1269	1	Altingia excelsa	3·35	0	4	2	1	5
155	E 1270	1	Alstonia scholaris	1·5	0	1	10	1	5
156	E 1271	1	Machilus odoratissima ...	4·1	0	8	2	2	0
157	E 1049	1	Michelia Champaca... ...	3·25	0	7	3	2	5
158	E 1268	1	„ oblonga	1·9	0	4	4	2	5
159	E 1267	1	Premna longifolia	3·5	0	7	10	2	5
160	D 1085	1	Acrocarpus fraxinifolius ...	1·8	0	2	8	1	10
161	E 1263	1	Albizzia procera	1·6	0	2	0	1	5
162	B 1453	1	„ Lebbek (Siris) ...	1·45	0	1	5	1	0
163	E 1266	1	Cedrela Toona (Toon) ...	0·8	0	5	8	2	5
164	E 763	1	„ „ „ ...	1·8					
165	E 1260	1	Chikrassia tabularis ...	0·95	0	1	2	1	0
166	E 512	1	Artocarpus Chaplasha ...	2·95				2	0
167	E 629	1	„ „ ...	0·75	0	15	7	2	0
168	E 721	1	„ „ ...	4·05				2	0
169	E 639	1	Cinnamomum glanduliferum ...	0·55				4	0
170	E 628	2	„ „ ...	3·25				4	0
171	B 2482	1	„ sp. (Hmanthin) ...	0·85	1	3	2	4	0
172	B 2483	1	„ sp. (Karaway) ...	1·1				4	0
173	B 511	2	Hopea odorata (Thingan) ...	10·15	0	17	9	1	15
174	B 2480	1	Dipterocarpus tuberculatus (Eng)	4·75	0	13	10	2	0
175	B 1048	1	„ „ „	2·2				2	0
176	E 709	1	„ turbinatus ...	3·55	0	6	4	1	15
177	E 1958	1	Eugenia Jambolana... ...	3·25	0	4	10	1	10
178	O 1460	1	Dalbergia Sissoo (Sissú) ...	5·95	1	6	11	4	10
179	B 1386	1	Pentace burmanica (Thitka) ...	5·85	0	13	3	2	5
180	O 1457	1	Gemelina arborea	5·85	1	3	4	2	0
181	C 835	2	„ „	5·8				2	0

No. of Lot.	No. of Office List.	No. of pieces.	Name.	Weight in cwt.	Amount received. £.	s.	d.	Rate per ton. £.	s.
182	E 2306	1	Morus cuspidata	2·45	0	3	8	1	10
183	B 561	3	Stephegyne parvifolia ...	9·55	0	16	8	1	15
184	B 577	2	Dillenia pentagyna	10·95	1	7	4	2	10
185	W 1224	1	Strychnos Nux-vomica ...	5·45	0	10	10	2	0
186	£ 1274	1	Isonandra polyantha ...	4·1	1	10	4	3	0
187	E 1275	1	,, polyandra ...	6				3	0
188	E 1259	1	Dysoxylum Hamiltonii ...	1·9	0	7	1	1	15
189	E 631	2	,, procerum ...	2·15				1	15
190	E 1276	1	Cynometra polyandra ...	3·6	0	6	4	1	15
191	B 1428	2	Cordia fragrantissima (Toungkala-met)	3·85	0	17	4	4	10
192	B 521	2	Diospyros Kurzii (Marblewood)...	8·5	1	6	9	2	15
193	C 1237	1	,, Melanoxylon (Ebony)...	1·25				2	15
194	E 401	1	Heritiera littoralis (Sundri) ...	2·2	0	3	3	1	10
195	D 1283	1	Mimusops indica	4·4	5	18	4	4	15
196	W 1223	1	,, Elengi	20 5				4	15
197	E 1273	1	Mesua ferrea (Nagesur) ...	2·65	1	1	6	2	15
198	E 2309	2	,, ,, ,, ...	5·15				2	15
199	B 1452	1	Berrya Ammonilla (Trincomali wood)	1·2	0	17	11	3	15
200	E 796	1	Taxus baccata (Yew) ...	2·3				3	15
201	C 1238	1	Pterocarpus Marsupium (Bejasal)	1·3				3	15
202	B 526	1	,, indicus (Padouk) ...	11·7	9	13	0	16	10
203	W 755	1	Terminalia tomentosa (Saj) ...	2·2	0	12	11	1	15
204	C 1241	1	,, ,, ,, ...	1·75				1	15
205	D 1281	1	,, ,, ,, ...	3·5				1	15
206	W 1221	1	,, paniculata ...	16·05	2	4	2	2	15
207	E 635	1	Shorea robusta (Sál) ...	1·4	3	13	10	2	0
208	O 1215	2	,, ,, ,, ...	10·55				2	0
209	B 556	4	,, obtusa (Thitya) ...	24·9				2	0
210	B 555	3	,, siamensis (Engyin) ...	17·55	1	19	6	2	5
211	C 800	1	Hardwickia binata (Anjan) ...	5·55	1	14	1	3	10
212	D 1055	1	,, ,, ,, ...	4·2				3	10
213	C 843	1	Acacia arabica (Babúl) ...	3·25	0	8	3	1	10
214	P 944	1	,, modesta (Phulahi) ...	2·25				1	10
215	W 1222	1	Xylia dolabriformis (Ironwood)...	10·25	1	0	6	2	0
216	W 1226	1	Ougeinia dalbergioides (Sandan)	11·75	1	15	3	3	0
217	W 1227	2	Dalbergia latifolia (Rosewood) ...	24 65	16	12	10	13	10
218	B 558	1	Schleichera trijuga (Kúsum) ...	4 45	0	8	10	2	0
219	O 1362	1	Amoora Rohituka	2·3	0	6	8	1	5
220	E 1261	1	,, ,, ...	1·2				1	5
221	E 1255	1	,, spectabilis	1 8				1	5
222	E 402	1	Carapa obovata	1·95	0	3	1	3	0
			Total ...	401·25	71	1	1		

Prices Current in the Calcutta Market, from Messrs. Mackenzie, Lyall & Co.'s Circular of December 31st, 1878.

RANGOON TEAK.

Mast Pieces, good large	... Rs. 5 to 12 per running foot.	}	Quotations nominal.
Ditto, small ...	...		
Sawn Timbers ...	... „ 65 to 75 per ton.		
Planks, long length ...	... „ 80 do.	}	Ditto.
Sheathing Boards, ½ inch ...	} „ 90 to 95 do.		
Ditto, ¾ inch ...			
Boards 1 inch	... „ 95 to 100 do.		

MOULMEIN TEAK.

Square Timbers, 20 to 29 feet long,
10 to 13 inches square, first-class, Rs. 80 to 85 per ton of 50 cubic feet.

Ditto, 20 to 45 feet long, 14 to 18 inches square	„ 100 to 130	do.
Second-Class Timber ...	„ 50 to 60	do.
Planks, long lengths, first-class ...	„ 90 to 95	do.
Furniture Planks, 23 to 27 feet long, 18 to 36 inches broad, and 1 to 2 inches thick—good ...	„ 115 to 150	do.
Sheathing Boards, ½ inch, double	„ 100	do.
Ditto, ¾ inch ...	„ 100 to 105	do.
Scantlings (of sizes) ...	„ 60 to 80 per ton.	

OTHER KINDS.

Moulmein Cedar, Square Timber	Rs. 65	per ton.
Thingan and Consohe ...	„ 45 to 50	„
Agilwood	„ 70 to 75	„
Saul, small	} „ 60 to 110	„
Do., large		
Johore Teak Scantlings ...	„ 70 to 75	„

AMERICAN AND COLCNIAL TIMBER.

American Lumber ...	... Rs. 55 per 1,000 surp. feet of 1 inch thick[ness.	
American Pine Planks, 2 and 3 inches thick ...	... „ 40 to 50	per do. do.
Mast Pieces, large ...	... „ 5 to 8	per running foot. Nominal.
Spars, large ...	... „ 1-12	per do. do. ditto.
Ditto, small ...	... „ 0-10 to 1	ditto.
Mahogany ...	... As. 6½ to 8	per supt. foot of 1 inch thick.
Deal Boards ...	... Rs. 0 to 0	per 1,000 feet.
Ash Oars	... As. 5½ to 6	per foot.

Wholesale London Price List of Mahogany and Fancy Woods.—From "The Timber Trades' Journal" of November 9th, 1878.

		s.	d.		s.	d.
Mahogany, per foot superficial						
Honduras (cargo aver.)	...	0	4	to	0	5½
Mexican „ ...	...	0	4	„	0	4½
Tabasco „ ...	...	0	4½	„	0	5½
Cuba „ ...	...	0	6	„	0	9
St. Domingo „ ...	...	0	6	„	0	9
Do. Curls „ ...	...	0	10	„	1	6
Cedar—						
Cuba „ ...	...	0	4½	„	0	5
Honduras & Mexican „ ...	...	0	4¼	„	0	5
Australian „ ...	...	0	3	„	0	4
Pencil „ ...	...	0	2	„	0	2½
Walnut „ ...	...	0	4½	„	0	5½
Black Sea „ ...	...	0	5	„	0	7
Canadian „ ...	...	0	3½	„	0	4½
Bird's-eye Maple „ ...	...	0	4	„	0	7
Satinwood—St. Domingo...	...	0	7	„	1	6
Bahamas (per ton) ...		£ 5	0	to	£ 9	0
Rosewood—Rio „ ...		£14	0	„	£25	0
Bahia „ ...		£12	0	„	£20	0
Zebrawood—Puerto Caballo		£ 6	0	„	£ 8	0
Ebony—Ceylon (per ton)		£12	0	„	£20	0
African Billet „ ...		£ 7	0	„	£12	0
Lignum Vitæ „ ...		£ 6	0	„	£ 9	0
Cocuswood (Cuba) „ ...		£ 5	0	„	£ 8	0
Boxwood (Turkey) „ ...		£ 6	0	„	£20	0

V. Extracts from Official Gazettes.

1.—Gazette of India—

No. 1093F.—1*st November* 1878.—The Governor-General in Council has been pleased to make the following permanent promotions in the Forest Department, with effect from the 2nd June 1878 :—

Mr. A. T. Drysdale, Officiating as Deputy Conservator of Forests of the 2nd grade in Berar, is confirmed in that grade.

Mr. A. Pengelly, M.A., Assistant Conservator of Forests of the 1st grade in the Punjab, is promoted to be a Deputy Conservator of Forests of the 3rd grade.

Mr. G. H. Foster, Officiating as Assistant Conservator of Forests of the 1st grade in the Central Provinces, is confirmed in that grade.

No. 1160F.—3*rd December* 1878.—The Honorable the President in Council has been pleased to appoint *Mr. A. Weston*, Assistant Patrol, Inland Customs Department, to officiate on probation as a Sub-Assistant Conservator of Forests, with effect from the 7th November 1878, the date on which he joined his appointment.

Mr. Weston is posted to British Burma.

No. 1193F.—12*th December* 1878.—*Mr. G. W. Strettell*, Deputy Conservator of Forests of the 2nd grade in Bengal, is allowed four days' subsidiary leave, in extension of that granted to him in the notification by this Department, No. 794F, dated the 16th August last.

2.—Gazette of North-West Provinces and Oudh—

No. 736A.—3*rd December* 1878.—*Mr. C. J. Ponsonby*, Deputy Conservator of Forests, having reported his return on the 12th November 1878, from the furlough granted him, the unexpired portion thereof is hereby cancelled, and the usual subsidiary leave is granted to him to enable him to rejoin his appointment.

No. 764A.—*7th December* 1878.—*Mr. E. P. Dansey*, Assistant Conservator of Forests, returned from the three months' privilege leave granted to him in Notification No. 223A, dated the 10th July 1878, on the forenoon of the 5th November 1878.

No. 808A.—*24th December* 1878.—*Mr. O. Greig*, Assistant Conservator of Forests, 2nd grade, three months' privilege leave from 1st December 1878, or subsequent date.

3.—PUNJAB GAZETTE—

No. 405F.—*7th November* 1878.—*Mr. G. G. Minniken*, Assistant Conservator of Forests, 1st grade, is transferred to the Sutlej Division.

Mr. Minniken is, under the terms of the Bashahr forest lease, invested with the powers of a Magistrate of the 2nd class, as described in section 20 of the Criminal Procedure Code, within the limits of the Bashahr State for the purpose of trying offences against the Forest Rules in force in that State.

7th November 1878.—*Mr. F. D. A. Vincent*, Assistant Conservator of Forests, is transferred from the Jhelum Division to the charge of the Plantation Division.

No. 444F.—*11th December* 1878.—*Mr. E. A. Down*, Officiating Assistant Conservator of Forests, Plantation Division, rejoined his appointment on the forenoon of the 30th November 1878, on return from the privilege leave of absence granted to him in *Punjab Government Gazette* Notification No. 378F., dated 19th October 1878.

4—CENTRAL PROVINCES GAZETTE—

No. 4878.—*19th November* 1878.—Under section 37 of Act X. of 1872, the Chief Commissioner is pleased to appoint *Mr. G. F. Taylor*, Sub-Assistant Conservator of Forests at Allapilli, in the Chanda District, to be a Magistrate of the 3rd Class in that district.

No. 5302.—*23rd December* 1878.—*Mr. E. Ludlow*, Assistant Conservator of Forests, having reported his

arrival at Nagpur on the 5th December 1878, is posted to the Mandla District.

Mr. H. Moore, Assistant Conservator, is transferred from Chanda to Nagpur.

5.—BOMBAY GAZETTE—

No. 5637.—*4th November* 1878.—*Mr. W. J. C. Dunbar,* Assistant Conservator of Forests, passed with credit the Forest Departmental Examination on 28th ultimo.

No. 6037.—*23rd November* 1878.—*Mr. W. S. Hexton,* Assistant Conservator of Forests of the 1st grade, has been permitted by the Secretary of State for India to return to duty within the period of his leave.

No. 6396.—*11th December* 1878.—*Major J. G. McRae* is confirmed in the appointment of Conservator of Forests in Sind, *vice Mr. J. McLeod Campbell,* who has vacated that appointment under section 16 (*b*) of the Civil Leave Code.

No. 6396A.—*11th December* 1878.—The following Notification to be substituted for the one published in the *Government Gazette* of 12th instant, under No. 6396, at page 829 :—

Major J. G. McRae is confirmed in the appointment of Conservator of Forests in Sind, *vice Mr. J. McLeod Campbell,* who has vacated that appointment under section 16 (*b*) of the Civil Leave Code, with effect from the date of *Mr. Campbell* vacating the appointment.

Classified List of Officers of the Forest Department

No. of Officers in each Class.	Names.	Vernaculars.	Province.	Date of Appointment to Grade.
	INSPECTOR-GENERAL OF FORESTS.			
	Mr. D. Brandis, PH. D. ...	.....	Head-Quarters of the Govt. of India	April 1, 1864
	CONSERVATORS—(7).			
	1st Class, Pay Rs. 1,600, (1).			
1	Mr. B. H. Baden-Powell, B.C.S	P. H.	Punjab ...	Aug. 1, 1876
	2nd Class, Pay Rs. 1,400, (1).			
2	Major W. J. Seaton, M.S.C. ...	P. H.	Burma (Tenasserim Circle.)	Aug. 1, 1876
	3rd Class, Pay Rs. 1,200, (2).			
3	*Mr. W. Schlich, PH. D. ...	Sindi (colloquial)	Bengal ...	Mar. 1, 1876
4	Capt. J. C. Doveton, M.S.C....	H. S.	Central Provinces	Aug. 1, 1876
	4th Class. Pay Rs. 1,000, (3).			
5	Captain E. S. Wood... f	H. S.	Oudh ...	Oct. 10, 1868
6	„ G. J. VanSomeren, 25th M. N. I. ...	P. H	Mysore and Coorg	Jan. 6, 1869
7	Mr. G. Greig ... c	L. S.	N.-W. Provinces (Central Circle.)	Nov. 14, 1876
	* Mr. B. Ribbentrop ...	L. S.	Burma (Pegu Circle)	July 4, 1878
	Captain F. Bailey, R. E. ...	L. S.	N.-W. Provinces (School Circle.)	Sep. 1, 1878
	DEPUTY AND ASSISTANT CONSERVATORS—(84.)			
	I.—India List.			
	DEPUTY CONSERVATORS—(23).			
	1st Grade, Pay Rs. 900, (5).			
1	Mr. H. Leeds	.....	Central Provinces	Dec. 2, 1872
2	*Lieut.-Col. C. Batchelor, 3rd B. E. L. C.*	*P. H.*	*Punjab* ...	*Nov.* 5, 1873
3	Lieut.-Col. W. Stenhouse, late 32nd M. N. I. ...	P. H.	Punjab ...	Mar. 17, 1876
4	Mr. I. E. O'Callaghan ...	L. S.	N.-W. Provinces (School Circle.)	June 2, 1878
5	*Vacant*	.....	.....	.....
	2nd Grade, Pay Rs. 700, (7).			
6	Mr. W. Jacob	.....	Bengal ...	Jan. 4, 1871

under the Government of India on the 1st October 1878.

Salaries.			Age last Birthday.	Date of first Appointment to Forest Dept.	Period of Service counting for Pension.	Remarks.
Substantive Pay.	Offg Local or Personal allowance.	Total.				
Rs.		Rs.			Y. M. D.	
2,000	.....	2,000	54	Jan. 16, 1856	21 6 24	
1,600	.....	1,600	37	April 1, 1869	9 6 0	Counts 17 years in all.
1,400	.....	1,400	41	Dec. 7, 1860	14 10 28	
1,200	.....	1,200	38	Dec. 21, 1866	11 9 11	
1,200	.....	1,200	39	April 8, 1864	14 5 23	Exclusive of Mily. Service.
1,000	.....	1,000	42	Feb. 1, 1864	12 2 0	
1,000	.....	1,000	36	May 9, 1864	.....	
1,000	.....	1,000	40	Dec. 14, 1868	9 3 19	
1,000	.....	1,000	35	Dec. 21, 1866	11 8 14	Appointment of Deputy Consr., 2nd Grade, Burma list, kept vacant.
1,000	.....	1,000	38	Aug. 24, 1871	.....	Appointment of Deputy Consr., 1st Grade, India list, kept vacant.
900	.....	900	52	June 17, 1858	18 9 25	
900	.....	900	48	*April* 1, 1865	.....	*On Furlough.*
900	.....	900	38	Dec. 5, 1862	.....	
900	.....	900	56	May 8, 1864	14 4 23	
.....	.....	.....	.....	.....	.....	See under Conservators (Captain F. Bailey.)
700	.....	700	45	May 24, 1864	17 4 7	

Classified List of Officers of the Forest Depart

No. of Officers in each Class.	Names.	Vernaculars.	Province.	Date of Appointment to Grade.
	DEPUTY CONSERVATORS—*continued.*			
	2nd Grade, Pay Rs. 700–contd.			
7	Mr. B. Browne ... c	H. S.	Punjab ...	May 11, 1871
8	Major H. C. T. Jarrett, vc., B.S.C.	P. H.	N.-W. Provinces (School Circle)	Jan. 1, 1873
	Mr. G. W. Strettell ...	*Sindi (colloquial.)*	*Bengal* ...	*Sep.* 27, 1873
9	„ C. F. Amery ...	.....	Punjab ...	April 1, 1875
10	„ R. H. E. Thompson ...	.....	Central Provinces	April 1, 1875
11	„ *A. L. Home* ...	*L. S.*	.....	*April* 1, 1875
12	„ A. T. Drysdale c	H. S.	Berar ...	June 2, 1878
	3rd Grade, Pay Rs. 500, (11).			
13	Capt. C. W. Losack g	L. S.	Central Provinces	Sep. 27, 1872
14	Mr. G. Mann	L. S.	Assam ...	Mar. 17, 1876
15	„ W. R. J. Brereton ...	L. S.	N.-W. Provinces (Central Circle)	Oct. 13, 1876
16	„ *C. J. Ponsonby* c	*S.L.S.—L.S.*	*Oudh* ...	*Oct.* 13, 1876
17	„ E. Sparling ...	.....	Punjab ...	Oct. 13, 1876
18	„ C. Bagshawe ...	L. S.	N.-W. Provinces (School Circle.)	Oct. 13, 1876
19	„ J. C. MacDonell c	L. S.	Bengal ...	Oct. 13, 1876
20	„ I. Macpherson ...	B.L.S., C.L.S	Mysore ...	Oct. 13, 1876
21	„ W. G. Allan c	L. S.	Oudh ...	Oct. 13, 1876
22	Captain J.E. Campbell, B.S.C.c	P. H.	N.-W. Provinces (Central Circle.)	Oct. 13, 1876
23	**Mr. A. Pengelly, M.A.* ...	*S. L S.*	*Punjab* ...	*June* 2, 1878
	ASSISTANT CONSERVATORS—(46).			
	1st Grade, Pay Rs. 450, (18.)			
1	*Mr. E. Ludlow*	*C. L. S.*	.....	*Nov.* 18, 1874
2	„ *W. Rigby* ... c	*L. S.*	*Punjab* ...	*Oct.* 13, 1876
3	„ R. S. Dodsworth c	H. S.	Oudh ...	Oct. 13, 1876
4	*„ E McA. Moir ...	L. S.	Punjab ...	Oct. 13, 1876
5	„ A. R. Grant ...	L. S.	N.-W. Provinces (Central Circle.)	Oct. 13, 1876
6	„ *H H. Davis* ...	*L. S.*	*Bengal* ...	*Oct.* 13, 1876
7	„ C. F. Elliott c	L. S.	Punjab ...	Oct. 13, 1876
8	„ R. H. M. Ellis b	L. S.	Ditto ...	Oct. 13, 1876
9	„ G. G. Minniken c	L. S.	Ditto ...	Oct. 13, 1876
10	„ W. H. Reynolds e	L. S.	Survey Branch ...	Oct. 13, 1876
11	„ J. M. Braidwood ...	L. S.	N.-W. Provinces (Central Circle.)	Oct. 13, 1876
12	*„ J. S. Gamble, M.A. ...	L. S.	Hd.-Qrs. of the Govt. of India.	Oct. 13, 1876

ment under the Government of India.—(Contd.)

Salaries.			Age last Birthday.	Date of first Appointment to Forest Dept.	Period of Service counting for Pension.			Remarks.
Substantive Pay.	Offg. Local or Personal allowance.	Total.			Y.	M.	D.	
Rs.	Rs.	Rs.						
700	.....	700	49	Dec. 15, 1868	28	11	14	Includes other Service.
700	.....	700	41	Sep. 28, 1866	.....			
700	.....	700	37	*Aug.* 13, 1867	11	11	7	*Temporarily transferred from Burma.*
700	.....	.....	45	July 1, 1865	11	6	3	Under Suspension.
700	.....	700	39	Jan. 1, 1860	17	9	22	
700	200	900	32	*Mar.* 1, 1864	10	8	17	*Asst. Comptroller General (Forests). Personal allowance.*
700	.....	700	33	June 27, 1868	10	3	4	
500	200	700	42	Dec. 25, 1867	10	9	6	Offg. 2nd Grade.
500	200	700	42	Dec. 1, 1864	13	2	3	Ditto ditto.
500	.....	500	33	Aug. 21, 1866	10	6	22	
500	.....	500	30	*May* 28, 1868	7	5	7	
500	.....	500	53	June 10, 1865	32	5	1	Includes other Service.
500	.....	500	31	Oct. 26, 1869	8	5	7	
500	.....	500	29	Aug. 1, 1867	7	6	16	
500	.....	500	31	Nov. 15, 1868	8	6	5	
500	.....	500	44	July 2, 1871	7	2	30	
500	.....	500	35	April 14, 1871	9	5	7	
500	.....	500	35	*Dec.* 16, 1869	8	9	16	*On Furlough.*
450	.....	450	33	*Jan.* 14, 1867	9	5	16	*Under Suspension.*
450	.....	450	35	*June* 29, 1865	9	7	28	On Furlough.
450	50	500	29	May 3, 1868	7	11	23	Offg 3rd Grade Dy. Consr.
450	50	500	30	Jan. 4, 1870	8	8	28	Ditto ditto.
450	50	500	35	June 10, 1867	10	7	2	Ditto ditto.
450	.....	450	32	*Oct.* 1, 1868	9	0	17	*On Furlough.*
450	.....	450	31	Jan. 17, 1868.	8	8	9	
450	.....	450	36	May 1, 1868	9	0	0	
450	...	450	31	Feb. 26, 1869	9	7	4	
450	150	600	35	Jan. 1, 1871	7	9	0	Persl allowance as Deputy Sudpt. of Forest Surveys.
450	.....	450	38	Nov. 9, 1870	7	10	22	
450	200	650	31	Jan. 2, 1872	6	8	30	Local allowance as Asst. to Inspector-General.

Classified List of Officers of the Forest Depart

No. of Officers in each Class.	Names.	Vernaculars.	Province.	Date of Appointment to Grade.
	ASSISTANT CONSERVATORS—*continued.*			
	1st Grade, Pay Rs. 450.–contd.			
13	Mr. W. P. Thomas c	L. S.	Central Provinces	Oct. 13, 1876
14	„ W. Shakespear c	L. S.	Punjab ...	Oct. 13, 1876
15	„ E. Forrest	L. S.	Punjab ...	Oct. 13, 1876
16	*„ J. T. Jellicoe a	C. L. S.	Mysore ...	Oct. 13, 1876
17	„ J. McKee ... c	L. S.	Central Provinces	Feb. 9, 1877
18	„ G. H. Foster ...	P.P. test in H.	Ditto ...	June 2, 1878
	2nd and 3rd Grades, Pay Rs. 350 *and Rs.* 250, (28).			
19	Mr. L. A. W. Rind c	L. S.	N.-W. Provinces (School Circle.)	April 1, 1875
20	*„ E. P. Dansey ...	L.S., B.L.S.	Ditto ...	April 1, 1875
21	*„ F. B. Dickinson ...	C. L. S.	Coorg ...	April 1, 1875
22	*„ D. E. Hutchins ...	C. L. S.	Mysore ...	April 1, 1875
23	*„ W. R. Fisher, B.A. ...	L. S.	Assam ...	Sept. 25, 1875
24	*„ E. E. Fernandez ...	L. S.	Central Provinces	April 12, 1876
25	*„ A. Smythies, B.A. ...	L. S.	N.-W. Provinces (School Circle.)	July 6, 1876
26	*„ W. Johnstone, L.C.E. ...	L. S.	Bengal ...	Aug. 7, 1876
27	*„ G. F. Prevost ...	L. S.	Berar ...	Oct. 13, 1876
28	*„ E. Fuchs	L. S.	Bengal ...	Oct. 13, 1876
29	„ J. Ballantyne h	L. S.	Berar ...	Oct. 13, 1876
30	„ F. O. LeMarchand c	L. S.	Punjab ...	Oct. 13, 1876
31	*„ S. E. Wilmot ...	L. S.	Oudh ...	Nov. 4, 1876
32	„ G. A. Richardson ...	L. S.	Bengal ...	Jan. 15, 1877
33	„ O. Greig ... a	L. S.	N.-W. Provinces (Central Circle.)	Feb 23, 1877
34	*„ E. D. M. Hooper ...	L. S.	Central Provinces	April 1, 1877
35	*„ F. D'A. Vincent ...	L. S.	Punjab ...	May 10, 1877
36	„ J. S. Mackay ...	L. S.	Ditto ...	Aug. 2, 1877
37	*„ E. G. Chester ...	L. S.	Bengal ...	Nov. 16, 1877
38	„ W. King ... c	L.S., C.L.S.	Mysore ...	Dec. 1, 1877
39	*„ W. E. D'Arcy ...	L. S.	Assam ...	Jan. 1, 1878
40	*„ A. J. Mein	L. S.	Ditto ...	Jan. 1, 1878
41	*„ F. B. Manson ...	L. S.	Bengal ...	Jan. 21, 1878
42	*„ H. Moore	L. S.	Central Provinces	June 13, 1878
43	„ E. Dobbs, B.A. c	L.S., C.L.S.	Ditto ...	Sept. 24, 1878
44	„ F. C. Hicks... ...	L.S., C.L.S.	Ditto ...	Mar. 23, 1868
45	*„ R. N. Anstruther ...	.....	Bengal ...	Dec. 19, 1874
46	„ H. B. Condon c	L. S.	Assam ...	Jan. 26, 1878

ment under the Government of India.—(Contd.)

Salaries			Age last Birthday.	Date of first Appointment to Forest Dept	Period of Service counting for Pension.	Remarks.
Substantive Pay.	Offg Local or Personal allowance.	Total.				
Rs.	Rs.	Rs.			Y. M. D.	
450	.....	450	28	Feb. 14, 1869	6 6 6	
450	.....	450	29	Mar. 27, 1869	7 5 21	
450	.....	450	28	Jan. 25, 1869	6 11 3	
450	.....	450	29	Nov. 22, 1871	6 10 9	
450	.....	450	29	Oct. 2, 1869	7 9 21	
450	.....	450	28	Dec. 17, 1868	6 11 28	
350	100	450	30	April 23, 1870	7 11 12	Offg., 1st Grade.
350	100	450	29	Dec. 20, 1872	5 9 11	Ditto ditto.
350	100	450	27	Dec. 22, 1872	5 9 10	Ditto ditto.
350	100	450	28	Dec. 22, 1872	4 11 1	Ditto ditto.
350	100	450	32	Dec. 16, 1872	5 9 16	Ditto ditto.
350	100	450	26	Dec. 5, 1873	4 9 27	Ditto ditto.
350	100	450	30	Dec. 10, 1873	4 9 22	Ditto ditto.
350	.....	350	31	Dec. 13, 1872	5 9 19	
350	.....	350	27	Dec. 25, 1873	4 9 7	
350	.....	350	26	Jan. 9, 1874	4 8 23	
350	.....	350	38	Oct. 19, 1868	9 11 13	
350	.....	350	29	Oct. 1, 1869	7 2 0	
350	.....	350	26	Dec. 10, 1873	4 9 22	
350	.....	350	29	Dec. 6, 1869	7 11 19	
350	.....	350	29	April 1, 1871	7 6 0	
350	.....	350	25	Dec. 8, 1874	3 9 24	
350	.....	350	26	Jan. 6, 1874	4 8 15	
350	.....	350	34	Jan. 15, 1870	8 0 0	
350	.....	350	26	Jan. 12, 1876	2 8 20	
350	.....	350	31	July 26, 1870	8 2 5	
350	.....	350	27	Jan. 4, 1876	2 8 28	
350	.....	350	27	Jan. 8, 1876	2 8 24	
350	.....	350	27	Jan. 26, 1876	2 8 6	
350	.....	350	25	Dec. 8, 1874	3 9 24	
350	.....	350	30	July 12, 1871	7 2 30	
250	.....	250	37	Sep. 1, 1866	12 1 0	
250	.....	250	26	Dec. 19, 1874	2 9 6	
250	.....	250	30	Jan. 19, 1869	9 8 24	

Classified List of Officers of the Forest Depart

No. of Officers in each Class.	Name.		Vernaculars.	Province.	Date of Appointment to Grade.
	SUB-ASSISTANT CONSERVATORS—(11).				
1	Mr. H. R. Ring	...	L.S.	Bengal ...	July 1, 1870
2	„ E. A. Down	...	L.S.	Punjab ...	May 29, 1871
3	Anwar Khan	...	.....	Ajmere ...	June, 1, 1872
4	Mr. C. E. Fendall	c	L.S.	Punjab ...	July 5, 1872
5	„ A. Stewart	c	L.S.	Berar ...	July 19, 1872
6	„ T. G. B. Atkinson	c	L.S.	Central Provinces	Aug. 2, 1872
7	„ E. F. Litchfield	c	L.S.	Survey Branch ...	Sept. 1, 1877
8	„ H. Calthrop	...	.....	Central Provinces	Nov. 10, 1877
9	„ W. M. Green	d	L.S.	Bengal ...	Jan. 25, 1878
1	„ A. N. Reuther	d	L.S.	Punjab ...	July 26, 1877
2	„ J. L. Huddleston	b	L.S.	Central Provinces	Aug. 23, 1877
3	„ H. B. Anthony	d	L.S.	Mysore ...	Sept. 4, 1877
4	„ A. Campbell	...	L.S.	Oudh ...	Feb. 19, 1878
5	„ D. P. Copeland	d	L.S.	Assam ...	Mar. 1, 1878
6	„ C. F. Rossiter	b	L.S.	Punjab ...	Mar. 12, 1878
7	„ J. C. Murray	c	L.S.	Survey Branch ...	April 25, 1878
8	„ G. F. Taylor	b	L.S.	Central Provinces	April 25, 1878
9	„ B. A. Rebsch	b	L.S.	Oudh ...	May 11, 1878
10	„ L. G. Smith	b	L S.	Bengal ...	July 14, 1878
11	„ H. G. Young	e	H.S.	Survey Branch ...	Oct. 1, 1878
	II.—British Burma List.				
	DEPUTY CONSERVATORS—(7).				
1	*2nd Grade, Pay Rs. 700, (3.)* *Vacant.*		.....	.....	.....
2	Mr. M. J. Slym	...	.....	Tenasserim Circle	Jan. 2, 1873
3	„ G. W. Strettell	...	Sindi (colloquial)	.....	Sept. 27, 1873
	3rd Grade, Pay Rs. 500, (4.)				
4	*Mr. J. Adamson*	...	L.S.	*Pegu Circle* ...	*Oct.* 13, 1876
5	* „ *A. E. Wild*	...	L.S.	*Pegu Circle* ...	*Oct.* 13, 1876
6	* „ R. H. C. Whittall	...	L.S.	Pegu Circle ...	Oct. 13, 1876
7	.....		.....	.....	.....
	ASSISTANT CONSERVATORS—(7.)				
1	*1st Grade, Pay Rs. 450, (4.)* *Mr. H. C. Hill	...	L. S.	Pegu Circle ...	Oct. 13, 1876

ment under the Government of India.—(Contd.)

Salaries.			Age last Birthday.	Date of first Appointment to Forest Dept.	Period of Service counting for pension.	Remarks.
Substantive Pay.	Offg. Local or Persl. allowance	Total				
Rs.	Rs.	Rs.			Y. M. D.	
200	50	250	31	July 1, 1870	8 3 0	Offg. Asst. Consr., 3rd Grade.
200	50	250	34	May 29, 1871	7 4 3	Ditto ditto
200	.....	200	42	Feb. 1, 1861	17 8 0	As a Native Doctor from Feb. 1, 1861.
200	50	250	28	March 6, 1871	6 5 12	Offg. Asst. Consr., 3rd Grade.
200	50	250	26	March 6, 1871	4 3 3	Ditto ditto.
200	.....	200	43	April 26, 1871	.....	On probation.
200	50	250	26	Oct. 16, 1876	4 8 8	Offg. Asst. Consr., 3rd Grade.
200	50	250	29	Nov. 10, 1877	0 10 22	Ditto ditto.
200	.....	200	22	May 28, 1877	1 4 3	
200	.....	200	23	July 26, 1877	1 2 6	
200	.....	200	25	Aug. 23, 1877	2 10 0	Includes other Service.
200	.....	200	23	Sep. 4, 1877	1 0 27	
200	.....	200	22	Feb. 19, 1878	0 7 9	
200	.....	200	24	March 1, 1878	0 7 0	
200	.....	200	26	Sept. 1, 1871	.....	
200	.....	200	26	April 25, 1878	4 1 16	Includes other Service.
200	.....	200	25	April 25, 1878	3 8 2	Ditto ditto.
200	.....	200	22	May 11, 1878	0 4 21	
200	.....	200	23	July 14, 1878	0 2 17	
200	.....	200	27	Oct. 1, 1878	5 5 9	Includes other Service.
...	.....	.....	.....	.....	.....	See under Consrs. (Mr. B. Ribbentrop).
700	200	900	54	Dec. 6, 1860	17 9 25	Offg. 1st Grade.
700	.....	700	57	Aug. 13, 1857	11 11 7	Temporarily transferred to Bengal.
500	.....	500	48	*April* 1, 1861	15 7 14	*On furlough.*
500	.....	500	31	*Dec.* 26, 1869	8 5 27	*Ditto*
500	.....	500	30	Nov. 25, 1871	6 10 6	
...	.....	.....	.....	.....	.....	Vacant on Oct. 23rd.
450	50	500	26	Dec. 23, 1872	5 9 9	Offg. Deputy Consr., 3rd Grade.

Classified List of Officers of the Forest Depart

No. of Officers in each Class.	Name.	Vernaculars.	Province.	Date of Appointment to Grade.
	ASSISTANT CONSERVATORS.—*(Contd.)*			
2	*Mr. E. P. Popert ...	B. L. S.	Pegu Circle ...	Oct. 13, 1876
3	„ C. F. Nepean c	B. L. S., G. L. S.	Tenasserim Circle	Oct. 13, 1876
4	Lieut. C. T. Bingham, R.S.C.	H. S.	Tenasserim Circle	Dec. 30, 1876
	2nd and 3rd Grades. Pay Rs. 350 and Rs. 250, (4.)			
5	* Mr. P. J. Carter ...	B. L. S.	Pegu Circle ...	June 23, 1877
6	* „ J. W. Oliver ...	B. L. S.	Pegu Circle ...	Nov. 21, 1877
7	* „ J. Nisbett ...	B. L. S.	Pegu Circle ...	Nov. 21, 1877
8	* „ T. H. Aplin ...	.....	Tenasserim Circle	Dec. 16, 1877
	SUB-ASSISTANT CONSERVATORS—(3).			
1	Mr. G. Stratford c	B. L. S.	Pegu Circle ...	Sept. 6, 1870
2	„ C. W. Palmer b	L. S.	Pegu Circle ...	April 30, 1872
3	„ H. B. Ward b	L. S.	Tenasserim Circle	Jan. 26, 1878

EXPLANATION OF

P. H. Passed in Hindustani, Old Standard.
H. S. „ „ Higher Standard.
L. S. „ „ Lower „
B. H. S. „ Burmese, Higher „
B. L. S. „ „ Lower „
C. H. S. „ Canarese, Higher „
C. L. S. „ „ Lower „
G. H. S. „ Guzerathi, Higher „
G. L. S. „ „ Lower „
S. H. S. „ Sindi Higher „
S. L. S. „ „ Lower „

* Appointed by H. M.'s Secretary of State for India as an Assistant Conservator of Forests.

a. Passed in Surveying by the Higher Standard, as defined in the Forest Department Code, para. 14.

b. Passed in Surveying by the Lower Standard, as defined in the Forest Department Code, para. 14.

ment under the Government of India.—(Conld.)

Salaries.			Age last Birthday.	Date of first Appointment to Forest Dept.	Period of Service counting for Pension.	Remarks.
Substantive Pay.	Offg. Local or Persl. allowance.	Total				
Rs.	Rs.	Rs.			Y. M. D.	
450	50	500	26	Dec. 28, 1872	5 9 4	Offg. Deputy Consr., 3rd Grade.
450	.....	450	46	Nov. 12, 1865	12 10 9	
450	.....	450	30	Dec. 30, 1876	1 9 2	Offg., exclusive of Military Service.
350	150	500	27	Jan. 19, 1876	2 8 13	Offg. Deputy Consr., 3rd Grade.
350	150	500	27	Dec. 19, 1874	3 9 13	Ditto ditto.
350	100	450	24	Jan. 26, 1876	2 8 6	Offg. Asst. Consr., 1st Grade.
250	.....	250	24	Dec. 16, 1877	0 9 16	
200	50	250	38	Sept. 6, 1870	6 0 19	Offg. Asst. Consr., 3rd Grade.
200	50	250	28	June 9, 1871	7 3 22	Ditto ditto
200	.....	200	26	June 21, 1877	1 3 10	

ABBREVIATIONS.

c. Qualified in Surveying under the orders by the Government of India of the 12th February 1869, or under previous orders.

d. Obtained the Certificate of Qualification as an Assistant Engineer at the Thomason Civil Engineering College, Roorkee.

e. Transferred from the Survey Department.

f Passed through the Officers' class at the Thomason Civil Engineering College, Roorkee, and received a Certificate of Qualification as an Engineer.

g. Passed the Course of Military Surveying at the Thomason Civil Engineering College, Roorkee.

h. Appointed by H. M.'s Secretary of State for India as a Forester.

Distribution List of Officers under the Government of India.

Forest Divisions and Sub-Divisions.	Officers in charge (Superior Staff.)	Area of Reserves in acres.	Area of Protected Forests in square miles.
GOVERNMENT OF INDIA.			
Forest Surveys ...	Mr. D. Brandis, Ph.D., Inspector-General of Forests ... ... Mr. J. S Gamble, M.A., Asst. to the Inspr.-Gnl. of Forests ... Mr. A. Smythies, B.A., Asst. Conservator of Forests (on special duty) Captain F. Bailey, R.E., Supdt. of Forest Surveys, Conservator and Director of the Forest School ... ... Mr. W. H. Reynolds, Asst. Conservator of Forests, and Depy. Supdt. of Forest Surveys ... Mr. E. F. Litchfield, Offg. Asst. Conservator of Forests ... ... Mr. H. G. Young, Offg. Sub-Asst. Conservator of Forests ... ... Mr. J. C. Murray, Offg Sub-Asst. Conservator of Forests		
	TOTAL ...		
BENGAL.			
Direction... ...	Mr. W. Schlich, Ph.D., Conservator ...	.....	.....
Office	Mr. R. N. Anstruther, Assistant Conservator ...	.....	.....
1. Darjeeling Division ...	Mr. J. C. McDonell, Depy. Conservator ...	16,640	.....
Gumpahar Range ...	Mr. L. G. Smith, Offg. Sub-Asst. Conservator ...		
2. Teesta Division ...	Mr. E. Fuchs, Assistant Conservator ...	36,480	.....
3. Kurseong „ ...	Mr. F. B. Manson, Asst. Conservator ...	49,920	.....
4. Jalpaiguri „ ...	Mr. H. R. Ring, Offg. Asst. Conservator ...	97,280	8
5. Buxa „ ...	Mr. G. A Richardson, Assistant Conservator ...	160,000	.....
6. Palamow „ ...	Mr. W. Jacob, Depy. Conservator	138,240	.....

Distribution List of Officers under the Government of India.—(Continued.)

Forest Divisions and Sub-Divisions.	Officers in charge (Superior Staff.)	Area of Reserves in acres.	Area of Protected Forests in square miles.
BENGAL.—(*Continued*)			
7. Sunderbuns Division ...	Mr. G. W. Strettell, Depy. Conservator ...	1,011,840	.....
8. Chittagong „ ...	Mr. E. G. Chester, Asst. Conservator ...	364,800	5,100
Cox Bazar Sub-Division	Mr. W. M Green, Offg Sub-Asst. Conservator...		
Hazáribágh Division ...	No Officer	320,000	.....
	TOTAL BENGAL ...	2,195,200 or 3,430 sq.	5,108 miles.
N. W. PROVINCES AND OUDH.			
CENTRAL CIRCLE.			
Direction... ...	Mr. G. Greig, Conservator	.....	.....
Office	Mr. J M Braidwood, Assistant Conservator ...	.....	.....
1. Kumaun Division ...	Captain J. E. Campbell, Deputy Conservator (on leave)	430,080	.....
	Mr. A. R. Grant, Offg. Deputy Conservator, 3rd grade, in temporary charge		
2. Ranikhet „ ...	Mr. W. R. J. Brereton, Offg. Deputy Conservator, 2nd grade ...	42,880	.....
Plantation and Nurseries	Mr. W. Craw, Superintendent		
3. Naini Tal Division ...	Mr. J. M Braidwood, Assistant Conservator ...	24,320	.....
4. Garhwal „ ...	Mr. A. R Grant, Offg. Depy. Conservator, 3rd grade	357,120	.....
Valuation Surveys ...	Mr. E. P. Dansey, Offg. Asst. Conservator, 1st grade (on leave) ...		
5. Bhagirathi Division ..	Mr. O. Greig, Asst. Conservator	Leased Forests	
6. Jhansi „ ...	... ...	23,680	.....
7. Lalitpur „ ...	... ...	92,800	.....
8. Bijnor „ ...	... ...	55,680	.....
	TOTAL CENTRAL CIRCLE ...	1,026,560	.....

Distribution List of Officers under the Government of India.—(Continued.)

Forest Divisions and Sub-Divisions.	Officers in charge (Superior Staff)	Area of Reserves in acres.	Area of Protected Forests in square miles.
FOREST SCHOOL CIRCLE.			
Direction	Captain F. Bailey, R E, Conservator and Director, Forest School	...	...
Dehra Dún Division ...	Mr. I. E. O'Callaghan, Deputy Conservator	171,496	None till the regazetting appears.
Saharanpur Sub-Division ..	Major H. C. T. Jarrett, V. C., Deputy Conservator ...	189,299	...
Jaunsar Division—			
I.—Office ...	Mr C. Bagshawe, Deputy Conservator	...	...
II.—Deota Range ...	Mr. L. A W. Rind, Offg. Asst. Conservator, 1st grade ...	7,188	...
III —Deogar Range...	In charge of Forester ...	...	...
IV.—Bawar Range ...	Do. do. ...	41,365	...
V.—Karamba Range.	Do. do. ...	19,081	...
VI —Lakandi Range ..	Do. do ...	7,729	...
VII.—Deoban Range...	Mr. C. Bagshawe, Deputy Conservator ...	8,788	...
VIII.—Kalsi Range ...	In charge of Forester ...	18,257	...
	TOTAL SCHOOL CIRCLE ..	463,203	...
OUDH CIRCLE.			
Direction	Captain E. S. Wood, Conservator	...	...
Kheri Division ...	Mr. R. S. Dodsworth, Offg Depy. Conservator Mr. A. Campbell, Offg. Sub-Asst. Conservator.,	265,600	20
Bahramghát Depôt ...	..	...	...
Bahraich Division ...	Mr S. E. Wilmot, Asst. Conservator .	179,200	...
Gonda do. ...	Mr. B. A Rebsch, Offg. Sub-Asst. Conservator .	69,760	...
Gorakhpur do. ...	Mr. W. G Allan, Deputy Conservator ...	80,000	...
Bareilly do. ...	... ...	107,520	...
	TOTAL OUDH CIRCLE ...	714,880	...
	GRAND TOTAL N. W. PROVINCES AND OUDH.	2,204,643 or 3,445 sq	... miles.

Distribution List of Officers under the Government of India.—(Continued.)

Forest Divisions and Sub-Divisions.	Officers in charge (Superior Staff.)	Area of Reserves in acres.	Area of Protected Forests in square miles.
PUNJAB.			
Direction	Mr. B. H. Baden-Powell, C.S., Conservator of Forests ...	...	...
Office	Ditto.		
On special duty ...	Mr. C. F. Amery, Deputy Conservator ...	...	...
1. Satlej Division ...	Mr. C. E. Fendall, Offg. Asst. Conservator. ...	24,320	...
2. Beas ditto ...	Lieut.-Col. W. Stenhouse, Deputy Conservator ...	120,960	...
Kulu Sub-Division ...	Mr J. S. Mackay, Asst. Conservator ...		
3. Ravi Division ...	Mr. B. Browne, Deputy Conservator ...	101,120	...
Lower Ravi Sub-Divn..	Mr. F. O. Lemarchand, Asst. Conservator ...		
4. Chenab Division ...	Mr. R. H. M. Ellis, Asst. Conservator ...	88,400	...
Lower Chenab Sub-Division	Mr. C. F. Rossiter, Offg. Sub-Asst. Conservator		
5. Jhelam Division ...	Mr. E. Sparling, Deputy Conservator ...	151,040	...
Lower Jhelam Sub-Division	Mr. E. Forrest, Asst. Conservator		
On special duty ...	Mr. F. d'A. Vincent, Asst. Conservator ...		
6. Rawalpindi Division...	Mr. C. F. Elliott, Asst. Conservator ...	363,520	...
7. Fuel Reserve Southern Division ...	Mr. W. Shakespear, Asst. Conservator ...	569,600	...
8. Fuel Reserve Northern Division ...	Mr. E. McA. Moir, Asst. Conservator ...	503,680	...
	Mr. A. N. Reuther, Offg. Sub-Asst. Conservator...		
9. Plantation Division ...	Mr. G. G. Minniken, Asst. Conservator ...	14,720	...
Lahore Rakhs Circle ...	Mr. E. A. Down, Offg. Asst. Conservator ...		
	TOTAL PUNJAB ...	1,887,360 or 2,948 sq.	... miles.

Distribution List of Officers under the Government of India.—(Continued.)

Forest Divisions and Sub-Divisions.	Officers in charge (Superior Staff)	Area of Reserves in acres.	Area of Protected Forests in square miles.
CENTRAL PROVINCES.			
Direction	Captain J. C. Doveton, Conservator.	5,671	...
Office	Mr. E D. M Hooper, Asst. Conservator.		
1 Mandla Division ...	Mr. H. Calthrop, Offg. Asst. Conservator, in charge.	190,346	2,118
Mandla Sub-Division...	Mr. T. G. B Atkinson, Sub-Asst. Conservator.		
2. Jubbulpore Division...	Mr. H. Calthrop, Offg. Asst. Conservator.	27,743	329
3. Hoshangabad Division	Mr. W. P. Thomas, Asst. Conservator.	247,680	1,223
4. Betúl Division ...	Mr. H. Leeds, Depy. Conservator.	181,760	860
5. Nimar Division ...	Mr. E. E. Fernandez, Asst. Conservator.	355,400	1,509
Kalibheet Sub-Division	Mr. J. E. L. Huddleston, Offg. Sub-Asst. Conservator.		
6. Chanda Division ...	Mr. R. H. E. Thompson, Depy. Conservator.	250,273	2,978
Ahiri Sub-Division ...	Mr. G. F. Taylor, Offg. Sub-Asst. Conservator.		
Do. on special duty...	Mr. H. Moore, Asst. Conservator.		
7. Seoni Division ...	Mr. J. McKee, Asst Conservator.	229,292	750
Korai Sub-Division ...	Mr. F. C. Hicks, Asst. Conservator.		
8. Chhindwarra Division..	Mr. E. Dobbs, Asst. Conservator.	70,400	641
9. Saugor Division ...	Mr. G. H. Foster, Asst. Conservator.	41,695	732
10. Nagpúr Division ...	Mr. E D. M. Hooper, Asst. Conservator.	.....	390
11. Bhandara Division ...	The Depy. Commissioner..	.....	551
12. Wardha Division ...	Ditto ditto ...	25,982	159
13. Balaghát Division ...	Ditto ditto ...	4,960	942
14. Damoh Division ...	Ditto ditto ...	.....	857
15. Narsingpúr Division...	Ditto ditto ...	.....	193
16 Raipúr Division ...	Ditto ditto ...	.....	1,377
17. Bilaspúr Division ...	Ditto ditto ...	.....	649
18. Sambalpúr Division ...	Ditto ditto ...	.....	695
	TOTAL CENTRAL PROVINCES	1,631,202 or 2,549 sq.	16,953 miles.

Distribution List of Officers under the Government of India.—(Continued.)

Forest Divisions and Sub-Divisions.	Officers in charge (Superior Staff.)	Area of Reserves in acres.	Area of Protected Forests in square miles.
BRITISH BURMA.			
TENASSERIM CIRCLE.			
Direction	Major W. J. Seaton, M.S.C., Conservator of Forests.		
Demarcation Staff ...	Lieut. C. T. Bingham, B.S.C., Asst. Conservator.		
1. Moulmein Division ...	Mr. M. J. Slym, Depy. Conservator.		
2. West Salween Division	Mr. H. B. Ward, Sub-Asst. Conservator.	54,400	246
3. East Salween Division..	Mr. C. F. Nepean, Asst. Conservator.		
4. South Tenasserim Division.	Mr. M. J. Slym, Depy. Conservator.		
5. Kadoe Revenue Station	Mr. T. H. Aplin, Asst. Conservator.	.....	...
	TOTAL TENASSERIM CIRCLE	54,400	246
PEGU CIRCLE.			
Direction	Mr. B. Ribbentrop, Conservator.	.....	
Timber Depôt and Agency	Mr. J. Allmark . .	.....	
Demarcation Staff ...	Mr. H. C. Hill, Offg. Depy. Conservator.	.....	
1. Rangoon Division ...	Mr. P. J. Carter, Offg. Depy. Conservator.	100,000	
2. Tharrawaddy Division...	Mr. R. P. Popert, Offg. Depy. Conservator.	142,136	Unknown.
3. Prome Division ...	Mr. J. W. Oliver, Offg. Depy. Conservator.	104,320	
4. Western Division ...	Mr. C. W. Palmer, Offg. Asst. Conservator.	.....	
5. Sittang Division ...	Mr. R. H. C. Whittall, Depy. Conservator.	9,260	
6. Shwegyeen Division ...	Mr. J. Nisbet, Asst. Conservator.	10,240	
	TOTAL PEGU CIRCLE ...	365,956	...
GRAND	TOTAL BRITISH BURMA ...	420,356 or 657 s q	246 miles.

Distribution List of Officers under the Government of India.—(Continued.)

Forest Divisions and Sub-Divisions.	Officers in charge (Superior Staff.)	Area of Reserves in acres.	Area of Protected Forests in square miles.
MYSORE AND COORG.			
Direction	Capt. G. J. VanSomeren, Conservator of Forests.	.....	...
1. Nagar Division ...	Mr. J. T. Jellicoe, Asst. Conservator.	72,320	51
	Mr. E. P. Lovery, Apprentice Asst. Conservator.		
2. Ashtagram Division ...	Mr. I. Macpherson, Depy. Conservator.	129,920	15
	Mr. H. B. Anthony, Sub-Asst. Conservator.		
	Mr. T. Abdul Karim, Apprentice Asst. Conservator.		
3. Nundidroog Division ...	Mr. D. E. Hutchins, Asst. Conservator.	80,726	26
4. Plantations ...	Mr. W. King, Asst. Conservator.	6,500	...
	TOTAL MYSORE ...	282,966 or 442 sq.	92 miles.
5. Coorg Division ...	Mr. F. B. Dickinson, Asst. Conservator.	189,166 or 295 sq.	25 miles.
	Mr. M. Muttannah, Apprentice Asst. Conservator.		
AJMERE-MHAIRWARRA ...	Mohamed Anwar Khan, Sub-Asst. Conservator.	60,853 or 95 sq.	... miles.
ASSAM.			
Direction	Mr. G. Mann, Depy. Conservator.	.....	...
1. Khasi Hills District ...	Mr. G. Mann, Depy. Conservator.	32,000	...
2. Gauháti Division ...	Mr. A. J. Mein, Asst. Conservator.	31,072	...
3. Tezpur do. ...	Baboo Jay Narain Das, Forest Ranger.	169,175	...
4. Golaghát do. ...	Mr. H. B. Condon, Asst. Conservator.	290,912	...
5. Goalpara do. ...	Mr. W. R. Fisher, B. A., Asst. Conservator.	.....	...
	Mr. D. P. Copeland, Offg. Sub-Asst. Conservator.	269,049	...
6. Cachar do. ...	The Assistant Commissioner	476,800	...
7. Sibságar do. ...	Mr. W. E. D'Arcy, Asst. Conservator.	.....	...
	TOTAL ASSAM ...	1,269,008 or 1,983 sq.	... miles.

Distribution List of Officers under the Government of India.—(Concluded.)

Forest Divisions and Sub-Divisions.	Officers in charge (Superior Staff.)	Area of Reserves in acres.	Area of Protected Forests in square miles.
HYDERABAD ASSIGNED DISTRICTS.			
Direction	Mr A. T. Drysdale, Depy. Conservator of Forests.		
1. Northern Division ..	Mr. A. T. Drysdale, Depy. Conservator of Forests.		
Melghát Sub-Division ...	Mr J. Ballantyne, Asst. Conservator of Forests.	545,920	710
Amraoti ditto ...	Mr. A. Stewart, Offg. Asst. Conservator of Forests.		
2. Southern Division ...	Mr. G. F. Prevost, Asst. Conservator of Forests.	351,360	156
	TOTAL HYDERABAD ...	897,280 or 1,402 sq.	866 miles.